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TRENCHLESS NORTH AMERICA



The Official Magazine of the North American Society for Trenchless Technology



NASTT 2026 NO-DIG NORTH

NOVEMBER 2 – 4, 2026 / CALGARY, ALBERTA

NASTT Member Organizations List Inside

FALL 2026

Volume 16 • Issue 4

nastt.org



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TRENCHLESS NORTH AMERICA



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FALL 2026 – VOLUME 16, ISSUE No. 4

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JOIN US AT THE 8TH ANNUAL NASTT NO-DIG NORTH CONFERENCE IN CALGARY!

The 2026 No-Dig North conference November 2 - 4 at the expansive TELUS Convention Centre in vibrant downtown Calgary will feature two full days and five tracks of stimulating technical sessions as well as Good Practice Courses preceding the first day of the conference. No-Dig North will also include an exhibit hall with over 100 exhibitors, showcasing the latest in leading edge trenchless technologies. Join us for this unparalleled in-person networking opportunity!



FEATURES

14 Q&A: Zulfiqar Khawaja M.Eng., P.Eng.

Zulfiqar Khawaja M.Eng., P.Eng., is this year's Chair of the 2026 No-Dig North Planning Committee, and Treasurer of the NASTT-NW Chapter. As the current Senior Project Engineer for Major Projects - Linear Infrastructure - Utilities Delivery at the City of Calgary, he is deeply involved with the Canadian trenchless community. As a high-school student Zulfiqar became fascinated with the archaeology of the 5,000-year-old Indus Valley civilization, particularly its well-planned streets, sanitary and drainage systems, and embarked on a lifelong career in civil engineering. He offers his perspective on the current and future state of trenchless technology.

19 Morty's Trenchless Academy: The World's Strongest Squeeze-Off Tool

Winner of the 2026 Abbott Award for Innovation, the C2400 Squeeze Boss manufactured by Footage Tools in Concord Ontario, fills a gap in available solutions for isolating large-diameter, heavy-wall HDPE pipelines. Designed for 16-inch to 24-inch HDPE pipe in SDR classifications from 7 through 21, the C2400 delivers more than 1.5 million pounds of force, approximately 791 tons, making it the strongest squeeze-off tool on the planet.

32 NASTT 2026-2027 Corporate Membership Listings

NASTT offers special recognition to its Corporate and Government, Utility and Education members in appreciation of their ongoing promotion of NASTT and the industry. The member lists are up to date as of September 2026. The NASTT Corporate, Government & Education Members are highlighted here, along with key contacts, websites and corporate logos – the NASTT community!

42 Challenging HDD Crossing In Northern Alberta: Installation with Over 230 Feet of Elevation Change

This paper is among those that received an outstanding score in the abstract review process among all the presentations at the NASTT 2026 No-Dig Show in Palm Springs CA. The award-winning paper outlines a recently completed challenging NPS 48 pipeline crossing of the Simonette River in Northern Alberta, by TC Energy using the HDD Intersection Method. Summary of the design and construction challenges along with the different mitigation strategies planned and used for the crossing.



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“Membership is about more than a list of benefits.”

“Your input is helping shape what comes next.”

WELCOME TO THE FALL 2026 EDITION OF NASTT'S TRENCHLESS NORTH AMERICA

Looking Ahead, Together

Dear NASTT Members and Trenchless Advocates:

As we head into the fall, NASTT is right in the middle of developing our next Strategic Plan – an opportunity to look closely at where we are today, where we want to go, and most importantly, what our members and industry need from us along the way.

Earlier this year, we asked our members to help guide that process through our Strategic Plan Survey, and I'm incredibly grateful to everyone who took the time to participate. Your feedback is helping shape the conversations happening now with our Board, staff, and volunteers as we think about NASTT's priorities for the years ahead.

One thing that continues to come through clearly is the importance of providing real value to our members. That means continuing to strengthen the benefits that come with NASTT membership, while finding new ways to make our education, technical resources, and industry connections even more valuable and accessible. Education has always been at the heart of NASTT, and as our industry continues to grow and change, we want to make sure we are growing with it.

That brings us to No-Dig North. This fall, we'll gather in Calgary for another opportunity to learn from one another, see what's happening across the trenchless industry, and build relationships with people doing this work throughout North America.

No-Dig North has continued to grow each year, and it has become an important part of how NASTT supports trenchless education and innovation in Canada while bringing together professionals from across our industry. Attendees can expect a strong technical program, a busy exhibit hall, and plenty of opportunities to connect – including our new Trenchless Roundup networking event this year.

Events like No-Dig North are also a good reminder that membership is about more than a list of benefits. NASTT is a community built around people sharing what they know – through conferences, courses, committees, technical resources, Regional and Student Chapters, and countless conversations between colleagues. Our job is to keep finding ways to make those opportunities more useful and meaningful for the people we serve.

There is a lot happening at NASTT right now, and I'm excited about where we're headed. Thank you to everyone who shared your perspective through our survey, and to all of our members who continue to give their time, expertise, and ideas to this organization. Your input is helping shape what comes next.

I look forward to seeing many of you in Calgary!

Kim Hanson

Kim Hanson, PE, Executive Director
North American Society for Trenchless Technology (NASTT)
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“There is a tremendous amount happening across NASTT.”

“I encourage you to take advantage of everything the conference has to offer.”

A FULL FALL AHEAD FOR NASTT

As we move into the final months of 2026, there is a tremendous amount happening across NASTT. From Regional Chapter conferences and educational events throughout North America to No-Dig North in Calgary and preparations for the 2027 No-Dig Show in Raleigh, our members, volunteers and partners continue to create opportunities to learn, connect and advance the trenchless industry.

For me personally, I am especially looking forward to welcoming the NASTT community to Canada for the **2026 No-Dig North, November 2–4 in Calgary**. As a Canadian, it is always a pleasure to see our industry gather on home territory, and Calgary is a fantastic setting for this year's conference.

No-Dig North continues to grow as Canada's premier trenchless technology conference, bringing together engineers, contractors, manufacturers, suppliers, municipal and utility representatives, students and other industry professionals. This year's program begins with NASTT Good Practices Courses on Monday, followed by two days of technical sessions, exhibits and networking opportunities. Whether you are joining us from across Canada, the United States or farther afield, I encourage you to take advantage of everything the conference has to offer.

Of course, Calgary is just one stop on a very busy fall calendar for NASTT. Our Regional Chapters have an outstanding lineup of events planned throughout September and October. Members can connect at events including GLSLA Trenchless Insights in Vaughan, Ontario; Northwest Chapter luncheons in Calgary and Edmonton; the Midwest Trenchless Technology Conference in Detroit; the Southeast Annual Conference in Clemson; the Pacific Northwest Trenchless Symposium in Seattle; the Western Chapter Annual Conference in Albuquerque; and the Mid-Atlantic New Frontiers in Trenchless Technology Seminar in Annapolis.

And while we are enjoying a busy fall, we are already looking ahead to our biggest gathering of 2027. The **NASTT 2027 No-Dig Show will take place March 21–25 in Raleigh, NC**. The No-Dig Show remains the largest trenchless technology conference in the world, bringing our industry together for an unparalleled week of technical education, training, exhibits, networking and knowledge sharing.

Municipal and utility professionals should also remember that applications are still being accepted for the **Municipal & Utility Scholarship Program for the 2027 No-Dig Show through November 8**. This program provides an excellent opportunity for eligible municipal and utility personnel to experience the No-Dig Show, connect with industry experts and bring valuable trenchless knowledge back to their organizations. I encourage our members and partners to share this opportunity with colleagues who could benefit from attending in Raleigh.

As we look toward Calgary, Raleigh and all the Regional Chapter events in between, I am continually reminded that NASTT's strength comes from the people who participate in our Society. Every volunteer who serves on a committee, every instructor who shares their expertise, every member who attends an event and every partner who supports our programs contributes to the continued growth of the trenchless community.

I hope to see many of you in Calgary this November. It will be wonderful to welcome the NASTT family to my home territory and to celebrate another year of education, innovation and connection across our industry.

Thank you for your continued support of NASTT, and I look forward to seeing you at an upcoming event.

Greg Tippet

**Greg Tippet, P. Eng., Board Chair
North American Society for Trenchless Technology (NASTT)**

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**No-Dig North, Calgary TELUS Convention Centre
November 2 - 4, 2026**

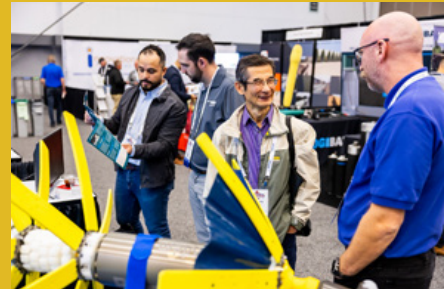
*Explore the Future of Trenchless Innovation at the
NASTT 2026 No-Dig North*

We can't wait to bring the trenchless community together again in 2026 in Calgary, Alberta, a vibrant city where innovation meets western hospitality, surrounded by the stunning Canadian Rockies! As Canada's leading trenchless technology event, No-Dig North attracts top industry professionals in engineering, construction, manufacturing, and municipal planning to exchange ideas and discover cutting-edge trenchless technologies that support sustainable, cost-effective infrastructure development.

The No-Dig North conference offers five topic tracks over the course of two days with peer-reviewed, non-commercial presentations, including case studies detailing environmentally friendly trenchless solutions and cost-saving opportunities. Additionally, an exhibition hall and networking events are offered throughout the week for opportunities to exchange ideas with colleagues. NASTT's suite of Good Practices Courses is offered on the first day of the conference as well.



Networking and close personal access to industry expertise is a central feature of the annual No-Dig North conference



Delegates have easy access to industry experts and trenchless technology exhibits featuring innovative new technologies

**For information and registration link please visit:
<https://nastt.org/no-dig-north/>**



Meet Us in Calgary

November 2 - 4 / Calgary TELUS Convention Centre

No-Dig North is the premier annual conference focused on trenchless technology in Canada. Attendees include engineers, contractors, manufacturers, and municipal representatives who seek to learn about and discuss sustainable, cost-effective solutions for infrastructure needs. The 2026 No-Dig North conference is coming to Calgary AB at the Calgary TELUS Convention Centre, November 2-4, 2026

Learn more at:
nastt.org/no-dig-north



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

No-Dig North Schedule



The NASTT No-Dig North conference helps you stay in touch and informed! Grow your network of business connections and stay on top of the latest trenchless developments during the show. (Schedule subject to change. Download the show app for the latest information.)

Monday, November 2, 2026

Attendee & Exhibitor Registration

7:00 am – 6:00 pm – Exhibit Hall Prefunction

NASTT's Introduction to New Installations

Good Practices Course

8:00 am – 12:00 pm – Room 202

NASTT's HDD Good Practices Course

8:00 am – 5:00 pm – Room 205

NASTT's CIPP Good Practices Course

8:00 am – 5:00 pm – Room 206

Chapter Chair Meeting

12:00 PM – 1:00 PM – Ideation 1

NASTT's Introduction to Rehabilitation

Good Practices Course

1:00 pm – 5:00 pm – Room 202

Student Kick-Off

4:30 pm – 5:30 pm – Room 209

Exhibit Hall Open & White Hat

Welcome Reception

5:30 pm – 7:30 pm – Exhibit Hall

Tuesday, November 3, 2026

Attendee & Exhibitor Registration

7:00 am – 6:00 pm – Exhibit Hall Prefunction

Opening Breakfast & Keynote

8:00 am – 9:45 am – Exhibit Hall

Technical Paper Session (Track 1)

10:00 am – 11:55 am – Room 202

Technical Paper Session (Track 2)

10:00 am – 11:55 am – Room 203

Technical Paper Session (Track 3)

10:00 am – 11:55 am – Room 205

Technical Paper Session (Track 4)

10:00 am – 11:55 am – Room 206

Technical Paper Session (Track 5)

10:00 am – 11:55 am – Room 209

Exhibit Hall Open

12:00 pm – 5:00 pm – Exhibit Hall

Lunch Concessions

12:00 pm – 3:00 pm – Exhibit Hall Prefunction

Technical Paper Session (Track 1)

2:30 pm – 3:55 pm – Room 202

Technical Paper Session (Track 2)

2:30 pm – 3:55 pm – Room 203

Technical Paper Session (Track 3)

2:30 pm – 3:55 pm – Room 205

Technical Paper Session (Track 4)

2:30 pm – 3:55 pm – Room 206

Technical Paper Session (Track 5)

2:30 pm – 3:55 pm – Room 209

Exhibit Hall Open & Social Hours

3:00 pm – 5:00 pm – Exhibit Hall

Trenchless Roundup Networking Event (ticketed event)

6:00 pm – 9:00 pm – The Guild (offsite)

Wednesday, November 4, 2026

Attendee & Exhibitor Registration

7:30 am – 2:00 pm – Exhibit Hall Prefunction

Morning Wake Up Station

7:30 AM – 8:30 AM – Glen Prefunction Foyer

Technical Paper Session (Track 1)

8:30 am – 10:55 am – Room 202

Technical Paper Session (Track 2)

8:30 am – 10:55 am – Room 203

Technical Paper Session (Track 3)

8:30 am – 10:55 am – Room 205

Technical Paper Session (Track 4)

8:30 am – 10:55 am – Room 206

Technical Paper Session (Track 5)

8:30 am – 10:55 am – Room 209

Exhibit Hall Open & Lunch Concessions

11:00 am – 2:30 pm – Exhibit Hall

Technical Paper Session (Track 1)

2:30 pm – 3:55 pm – Room 202

Technical Paper Session (Track 2)

2:30 pm – 3:55 pm – Room 203

Technical Paper Session (Track 3)

2:30 pm – 3:55 pm – Room 205

Technical Paper Session (Track 4)

2:30 pm – 3:55 pm – Room 206

Technical Paper Session (Track 5)

2:30 pm – 3:55 pm – Room 209

Northwest Chapter Meeting

4:30 pm – 5:30 pm – Ideation 3

GLSLA Chapter Meeting & Social

5:00 pm – 7:00 pm – Greta Bar (offsite)

No-Dig North Networking Events



The NASTT No-Dig North offers numerous **networking events** and a chance to enjoy a little fun with industry leaders in addition to extensive track sessions, educational opportunities and exhibit floor.



Exhibit Hall Opening & White Hat Welcome Reception

Date: Monday, November 2, 5:30 PM – 7:30 PM

Location: Exhibit Hall

About: The countdown is over. Join us as we officially open the 2026 No-Dig North with welcome drinks, appetizers, and

an evening of networking in the exhibition hall. Catch up with familiar faces, meet new industry peers, and set the stage for an exciting conference experience ahead. Don't forget to check in on Monday to collect your attendee badge and drink tickets before the festivities begin. We look forward to welcoming you to Calgary and celebrating the start of No-Dig North together!

This event is open to everyone and includes 2 drink tickets: Join us!



Opening Breakfast & Keynote Address

Date: Tuesday, November 3, 8:00 AM – 9:45 AM

Location: Exhibit Hall

About: Full Conference attendees are invited to the opening breakfast to visit with colleagues and learn all that is

in store for the week! Breakfast promptly served at 8:00 AM. Keynote address to follow. You will want to arrive on time to get your seat!

Breakfast is first come, first served for Full Conference registrants that RSVP'd during registration. Pre-registration is required. Be sure to check in on Sunday to get your attendee badge.



KEYNOTE SPEAKER

Michael Thompson is the General Manager of Infrastructure Services for the City of Calgary. He has a strong background in executive management, having worked with the City for almost 12 years in various senior leadership roles. Michael earned his Bachelor of Science in Engineering from the University of Calgary and completed his MBA at Queen's University. This education provides him with a comprehensive and business-oriented perspective to enhance decision-making. Prior to working for the City of Calgary he worked for a large consulting engineering firm, focused on planning, designing, and constructing large infrastructure projects. In his free time, Michael enjoys running, skiing, camping, and spending quality family time with his wife and three sons.



Exhibit Hall Social Hours (Cash Bars)

Date: Tuesday, November 3, 3:00 – 5:00 PM

Location: Exhibit Hall

About: Join colleagues in the exhibit hall after an action-packed day of

learning and networking to continue those conversations and switch gears before joining us at the Trenchless Roundup later in the evening! Cash bars will be located throughout the exhibit hall for all attendees to enjoy a refreshing beverage and socialize on our buzzing exhibit hall floor.

Open to everyone with an exhibit hall pass!



Trenchless Roundup Networking Event (Ticketed Event)

Date: Tuesday, November 3, 6:00-9:00 PM

Location: The Guild (offsite venue)

About: Round up your

colleagues and head to The Guild for one of No-Dig North's premier networking events. The Trenchless Roundup brings the industry together for an unforgettable evening of conversation, connection, and Calgary hospitality. Enjoy handcrafted cocktails, chef-inspired food stations, and a lively atmosphere designed for building new relationships and catching up with familiar faces. Whether you're reconnecting with longtime industry friends or meeting new contacts, this is the perfect opportunity to expand your network beyond the conference floor. Saddle up and join us for an evening where great conversations, great food, and great company take center stage. **Cost:** \$100

The Trenchless Roundup is a ticketed event held offsite taking place during 2026 No-Dig North. Purchase your ticket(s) when you register to attend the conference.

NETWORKING EVENTS | EXHIBIT HALL | TECHNICAL SESSIONS

<https://nastt.org/no-dig-north/>



with

Zulfiqar Khowaja

With over 26 years of experience in municipal infrastructure delivery, Zulfiqar Khowaja M.Eng., P.Eng., is currently a Senior Project Engineer for Major Projects - Linear Infrastructure - Utilities Delivery at the City of Calgary. Zulfiqar is deeply involved with the trenchless community, serving on the NASTT Northwest Chapter Board Executive as Secretary. He is a recognized Engineer in delivering high-risk, capital-intensive utility projects. Zulfiqar is proud to be the Chair of the 2026 No-Dig North Planning Committee. He shares his ideas on the current and future state of the trenchless technology industry.



What first inspired you to become interested in construction & engineering field, particularly underground construction?

I was not very clear at first about my career path or which university degree program I should select, but I was certain that I wanted to choose a field where my work would have a direct relationship with the public and improve quality of life. When I was in high school, we had a two-day trip to the archaeological site of the Indus Valley Civilization, Moenjo-daro. Seeing the advanced development features of a civilization more than 5,000 years old especially its planned streets, sanitary and drainage systems, public wells, bathing areas, and organized urban layout made me think seriously about civil engineering as my degree and future career field.

That interest grew stronger when I started working with AKDN (Aga Khan Development Network), which gave me the opportunity to work on utilities and high-rise building projects. Through those assignments, my interest developed more specifically toward utilities, and I became focused on pursuing a career in deep utilities for water, wastewater, and stormwater infrastructure. As a young engineer, I was also an active member of civil society and a vocal critic of government development criteria, especially when projects avoided meaningful consultation with Indigenous communities in Southern Pakistan. Those experiences reinforced my belief that infrastructure must be technically sound, socially responsible, and connected to the people it serves.

When I migrated to Canada, I pursued my M.Eng. degree with a major in Water Resources, which further shaped my professional direction toward municipal utilities, underground infrastructure, and trenchless construction. Over the years, particularly since joining the City of Calgary, my focus shifted intensely toward underground and trenchless

"As a young engineer, I was also an active member of civil society."

construction as I saw the necessity of minimizing disruption in growing municipalities while dealing with complex linear infrastructure.

Outline your experience of first being introduced to trenchless technology methods and applications.

My familiarity with trenchless installation methods started during my Master of Engineering studies in Toronto, where I had the opportunity to visit a couple of project sites involving traditional tunneling methods and microtunneling installations. Those early site visits helped me understand how underground construction could solve complex urban infrastructure challenges while reducing surface disruption. Later, while working in the oil and gas industry, I was involved in the design and execution of several auger boring projects, mostly for road crossings, which further strengthened my practical understanding of trenchless applications. That experience continued to grow during my time as a Project Engineer and later Senior Project Engineer with the City of Calgary, where I became involved in the planning, design, and construction of various microtunneling projects, HDD project, and pilot tube auger boring projects for major sanitary trunk sewers, water feeder mains, and stormwater trunks.

One key example was the BSFM replacement microtunneling work, which will be delivered on an expedited schedule. These experiences helped cement my practical understanding of trenchless methods and their value in

"These experiences helped cement my practical understanding of trenchless methods."

delivering complex underground infrastructure with reduced surface disruption.

How did you first get involved with NASTT? What are some of the goals and initiatives you would like to see NASTT pursue?

As I took on more complex trenchless projects, NASTT naturally became an invaluable resource for technical knowledge and professional networking. Attending NASTT short courses and conferences helped build my interest in becoming part of this great organization and contributing to the broader trenchless community.

I started by getting involved with the local Calgary Section and, over time became more active in supporting events, knowledge sharing, and industry engagement. I currently serve as Chair of the local Calgary Section and Secretary of the NASTT Northwest Chapter, and I have also served a few times as a technical reviewer. I would like to see NASTT continue to foster knowledge sharing around complex, large-diameter gravity trunks and pressurized systems, while also advancing practical training for emergency response protocols.

What are your thoughts on the current state of the trenchless industry? What areas do you see evolving in STEM education and post-secondary academics?

The trenchless industry is at a very important stage. In my view, it is no longer seen only as a specialized construction method; it is becoming an essential approach for delivering critical underground infrastructure in growing and congested urban environments. Municipalities, consultants, contractors, and owners are now looking more closely at risk assessment, constructability, lifecycle costing, ground conditions, utility conflicts, and public disruption before selecting the right delivery method. This is a positive shift because successful trenchless work depends not only on technology, but also on early planning, realistic risk allocation, good communication, and experienced teams working together.

From my own experience, the best outcomes happen when engineering judgment, field experience, and stakeholder expectations are aligned from the beginning. In STEM education and post-secondary academics, I would like to see more practical exposure to underground infrastructure,

"The trenchless industry is at a very important stage."

microtunnelling, HDD, geotechnical risk, condition assessment, and utility planning. Students need strong technical fundamentals, but they also need to understand how projects are actually planned, procured, constructed, and commissioned.

I also believe young engineers should be encouraged to build curiosity, communication skills, leadership, and a growth mindset, because trenchless projects require both technical confidence and the ability to work collaboratively under pressure. Bridging the gap between classroom learning and real project delivery will be very important for preparing the next generation of engineers.

Is the trenchless industry generally doing a good job of attracting young professionals? What do you think can be done to better engage students and young professionals in the trenchless industry?

We are making progress, but I believe there is still much more we can do to attract and retain young professionals in the

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trenchless industry. From my own journey, I can say that exposure, mentorship, and meaningful involvement make a real difference. As a Senior Project Engineer, I have had the opportunity to mentor and oversee EITs and young professionals through technical reviews, quality control, constructability discussions, and real project delivery.

When young engineers see how trenchless methods directly support communities by reducing disruption, protecting existing infrastructure, and delivering complex water, wastewater, and stormwater projects, they begin to see the purpose and value of this field. Organizations such as NASTT are already helping through local chapters, regional sections, student chapters with universities, short courses, conferences, technical paper opportunities, and student scholarships. These platforms are very important because they create a bridge between students, young professionals, owners, consultants, contractors, and experienced practitioners. I think we should continue strengthening university engagement, site visits, mentorship programs, student competitions, and practical case-study presentations so students can connect classroom learning with real underground infrastructure challenges.

To better attract professionals, the industry may also benefit from more visibility around career pathways, leadership opportunities, and even periodic compensation or workforce surveys that show young engineers the long-term professional growth available in trenchless technology. In my view, if we present trenchless as an innovative, community-focused, and technically rewarding career path, more young professionals will want to be part of it.

Biggest challenges facing the trenchless industry today? Has acceptance and understanding of trenchless technology improved?

Acceptance of trenchless technology has certainly improved as municipalities and utility owners recognize its value in reducing surface disruption, protecting communities, and delivering complex underground infrastructure in constrained urban corridors. However, from my experience in Western Canada, one of the biggest challenges is that we still do not have enough qualified contractors to create fair and consistent competition for certain specialized trenchless methods. In some cases, only a few contractors are technically capable of delivering complex microtunneling, HDD, or pilot tube auger boring work, and that limited market depth can drive installation costs higher.

Another practical challenge is that some experienced trenchless contractors may already be busy in other parts

of North America and may not always see Western Canada as an immediate market to pursue, which further limits competition and availability. Another factor is the shortage of locally trained contractors and crews with hands-on experience in these methods, which can increase both pricing and delivery risk. At times, this also creates concern or outcry from other contractors who may feel excluded from opportunities because the technical qualifications and experience requirements are difficult to meet.

I believe the solution is not to lower standards, but to build more local capacity through training, mentorship, workshops, prequalification transparency, and earlier industry engagement. Procurement, risk management, and schedule coordination also remain major challenges, especially when trenchless work must be delivered alongside rapidly expanding community developments and critical utility upgrades. In my view, successful delivery requires strong governance, clear scope alignment, realistic risk allocation, and open communication among owners, consultants, contractors, developers, and regulatory bodies from the earliest planning stages.

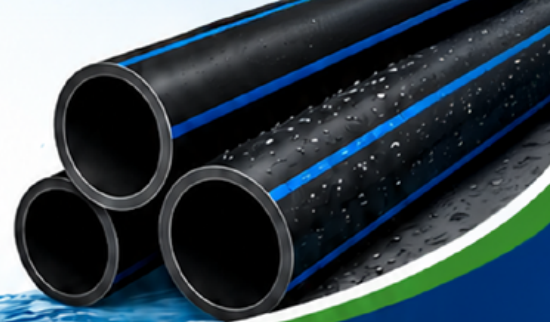
What do you personally enjoy most about working in the trenchless technology field?

I enjoy multidisciplinary collaboration and the challenge of solving high stakes technical problems. Taking a high-risk, capital-intensive utility project from feasibility and value planning all the way through successful commissioning is incredibly rewarding. In my current role with the City of Calgary, I have been fortunate to contribute to some of the City's major linear infrastructure projects, where trenchless methodologies are often essential to safely and efficiently cross rivers, rail tracks, major highways, and other sensitive or heavily used corridors while minimizing disruption to busy residential and commercial areas. These projects require careful planning, strong technical judgment, constructability review, geotechnical understanding, utility coordination, interested parties communication, and close collaboration with consultants, contractors, operations teams, and regulatory agencies.

Whether it is managing emergency repair works, optimizing project sequencing, supporting microtunneling, HDD, or auger boring applications, or presenting technical papers at NASTT events, I appreciate the continuous learning and the opportunity to deliver infrastructure that directly improves public service, protects communities, and supports long term municipal growth.

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TOP 10 Features & Benefits		HDPE	D. Iron
1	Applications: Potable Water (Lead Free), Raw Water, Reclaimed Water, and Wastewater	✓	✓
2	Open Cut Construction: Design and install per AWWA Standards and Manuals	✓	✓
3	Trenchless Construction: Material of choice for HDD, Pipe Bursting (Pneumatic + Static), Sliplining, and Compression Fit	✓	X
4	Fully Restrained Joint-Free System: Minimize need for fittings to facilitate horizontal and vertical deflections eliminating the need for thrust blocks	✓	X
5	Longevity & Corrosion: Pipes, Fittings, and Joints have the least potential for corrosion or tuberculation	✓	X
6	Flow Capacity: New pipes have similar flow capacity per AWWA Standards and Manuals	✓	✓
7	Water & Energy Conservation: Fused Joints have zero allowable water leakage and zero Infiltration	✓	X
8	Cost Effective: Has the lowest initial cost, lowest life cycle cost, and lowest restoration cost for trenchless installations	✓	X
9	Resilient: Ability to resist water hammer and ground movements due to droughts, freeze/thaw, earthquakes, and hurricanes with the ability to control flow with squeeze-off	✓	X
10	Permeation/BTEX: In contaminated conditions, pipes and elastomeric joints require proper engineering.	X	X

Sample References

- 1 AWWA C901, AWWA C906, AWWA C151, NSF 61, *NSF 2024 Health Effects of HDPE Pipes and Fittings for Potable Water Applications*
- 2 AWWA M55, AWWA M41, MAB-3, MAB-6
- 3 ASTM F585, ASTM F1962, ASTM F3508, MAB-5, MAB-7, MAB-11
- 4 AWWA M55, AWWA M41
- 5 NACE 2019 *Corrosion Management in the Water Treatment Sector*, PIPACE.com, UKWIR 2020 *Long-Term Aging of Polyethylene Pipes*

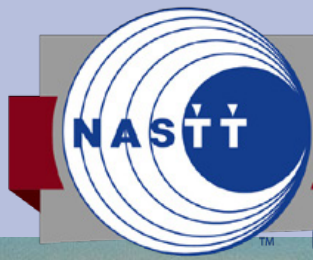
- 6 AWWA M55, AWWA M41 and PIPACE.com
- 7 AWWA M55, AWWA M41, ASTM F2620, ASTM F3190, ASTM F3565, MAB-1, MAB-2, MAB-8
- 8 CSIRO 2008 *Life Cycle Analysis of Water Networks*, Annual Drinking Water Quality Report for 2014, Kittery Water District, 5/31/15
- 9 WRF 2012 Recent Earthquakes: Implication for U.S. Water Utilities, Kubota 2018 Polyethylene Pipeline Performance Against Earthquake, MAB-9, MAB-10
- 10 AWWA C901, AWWA C906, AWWA C111, AWWA C151, Sec 4



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



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nastt.org/no-dig-show

The Strongest Squeeze-Off Tool On The Planet

C2400 Squeeze Boss Specifically Designed for Large-Diameter HDPE Pipeline Operations

By: Jim LaChapelle, Marketing Manager, Footage Tools

When Footage Tools identified a gap in available solutions for isolating large-diameter, heavy-wall HDPE pipelines, the result was the creation of the C2400 Squeeze Boss, the strongest squeeze-off tool on the planet.

Designed for 16-inch to 24-inch HDPE pipe in SDR classifications from 7 through 21, the C2400 delivers more than 1.5 million pounds of force, approximately 791 tons, for maintenance, repair, construction, and emergency response applications where temporary pipeline isolation is required.

Large-diameter HDPE pipe plays an important role across municipal water, industrial, and energy infrastructure projects. As these systems are maintained, repaired, modified, and expanded, operators require reliable isolation methods that allow work to be completed efficiently.

In many applications, conventional approaches can require full-line depressurization and extended drainage before work can begin. For operators working with large-diameter HDPE systems, temporary isolation can play an important role in supporting pipeline maintenance and repair activities.



**FOOTAGE
TOOLS**



Addressing the Challenge of Large-Diameter HDPE Isolation

Large-diameter HDPE systems present unique challenges when temporary isolation is required. Applications involving large-diameter, heavy-wall HDPE pipe, including SDR 7 configurations,





require substantial squeeze force and can present challenges for available isolation methods.

For operators working in municipal water, industrial, and energy environments, these challenges can become especially apparent during maintenance and repair activities. When practical isolation methods are unavailable, projects may require full-line depressurization, extended drainage, and additional operational planning before work can begin.

Footage Tools recognized that contractors and pipeline operators needed an engineered solution capable of addressing these demanding applications. The objective was not simply to increase squeeze force, but to develop a tool specifically designed for large-diameter HDPE pipeline operations.

The resulting C2400 Squeeze Boss was engineered for applications where available isolation options were previously limited. By combining substantial squeeze force with a platform designed for demanding field conditions, the tool supports a wide range of HDPE pipeline operations.

Built for Large-Diameter HDPE Applications

The C2400 is designed specifically for large-diameter, heavy-wall HDPE applications. Capable of generating more than 1.5 million pounds of force, approximately 791 tons, the tool provides the force required for demanding squeeze-off operations.

The tool is manufactured from precision-machined aircraft-grade aluminum and incorporates chrome-plated steel side shafts for durability and strength. An enhanced lock-in and swing-out bottom bar design helps simplify installation, while lock-down bolts maintain squeeze integrity even after hydraulic disconnection.

These features combine to create a tool designed specifically for large-diameter HDPE pipeline operations. The design reflects Footage Tools' focus on developing specialized tools for applications where conventional solutions may not meet operational requirements.

The C2400 was engineered for use across a range of municipal water, industrial, and energy applications where large-diameter HDPE pipe requires temporary isolation. Its combination of force, durability, and field-focused design supports demanding squeeze-off operations in a variety of environments.

Supporting Maintenance, Repair, and Construction Activities

The C2400 provides operators with an additional option for maintenance, repair, construction, and emergency response applications involving large-diameter HDPE systems.

By providing temporary pipeline isolation, operators can perform critical work without relying solely on full-line depressurization and drainage. Depending on the application, temporary pipeline isolation can help reduce downtime, drainage requirements, and the overall scope of maintenance activities. These efficiencies

"The resulting C2400 Squeeze Boss was engineered for applications where available isolation options were previously limited."

can contribute to lower project costs and reduced operational impacts compared to approaches that require full-line depressurization and extended drainage.

The tool has been utilized across industrial and energy systems throughout the United States since its first field deployments in 2025.

One application involved a 24-inch DRI7 domestic water main repair at Texas A&M University. By utilizing large-diameter squeeze-off technology, crews were able to isolate the affected section of pipeline and complete repairs without draining the entire system. The project also reduced the required excavation footprint by more than 50 percent compared to conventional repair methods.

The C2400 has also been used on produced water systems in the Permian Basin, where operators required a practical isolation method during repair and maintenance work. In these applications, the ability to isolate sections of pipeline helped support maintenance activities while minimizing operational disruption. In certain cases, operators were able to avoid three to four operating days compared to conventional maintenance approaches, helping reduce both downtime and project costs.

Additional applications have included booster station installations, infrastructure upgrades, and other projects requiring temporary pipeline isolation. In each case, operators required a practical method of controlling flow while maintenance, repair, or construction activities were completed.

These projects demonstrate how the C2400 can support a variety of field applications where large-diameter HDPE isolation is required.

"In addition to its field applications, the C2400 received the 2026 Abbott Award for Innovation from the North American Society for Trenchless Technology (NASTT)."

Industry Recognition

In addition to its field applications, the C2400 received the 2026 Abbott Award for Innovation from the North American Society for Trenchless Technology (NASTT).

Presented annually, the Abbott Award recognizes products and services that demonstrate meaningful advancement in trenchless technology and deliver real-world impact across the industry.

The award recognized the C2400's contribution to large-diameter HDPE pipeline operations and its advancement of squeeze-off technology for demanding applications.

The recognition highlighted Footage Tools' efforts to develop specialized solutions for infrastructure professionals working in municipal water, industrial, and energy markets.

Conclusion

Since its introduction, the C2400 has been utilized across municipal water, industrial, and energy applications throughout the United States. From water main repairs and produced water systems to infrastructure upgrades and booster station installations, the tool has provided operators with an additional option for temporary pipeline isolation in demanding HDPE applications.

By helping reduce downtime, drainage requirements, operational disruption, and project costs in certain applications, the C2400 continues to demonstrate the value of large-diameter squeeze-off technology for modern pipeline maintenance and repair.

Explore our complete range of tools and solutions at footagetools.ca, or contact our team at sales@footage.ca to learn more.

Meet the NASTT Staff



Meet the NASTT Staff

L-R- Victoria Cox, Regional & Student Chapter Manager; Jenna Hale, Marketing & Brand Strategy Manager; Amy Shipp, Volunteer Engagement Manager; Jessie Clevenger, Vice President of Operations & Conferences; Kim Hanson, PE, Executive Director; Kari Weber, Education Manager; Carolyn Hook, Membership Outreach & Database Manager; and Michelle Hill, Conference Services Director

NASTT is staffed by 8 full time employees who are dedicated association professionals, passionate about serving our members and the trenchless industry at large. With varying backgrounds and located throughout North America, we are equipped to assist our trenchless community with competent efficiency served with a smile!

To learn more about the NASTT Staff, visit us at <https://nastt.org/about/staff/> and contact us at info@nastt.org.



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Stronger Across Generations

Trenchless Leaders Share What They've Learned

By: Carolyn Hook, Membership Outreach & Database Manager

Today's workplace brings together professionals at very different stages of their careers, from those just entering the industry to those with decades of experience. What does that look like in practice? According to EY's Workforce Benefits Study, as Baby Boomers retire and Generation X ages, Millennials and Generation Z are projected to comprise a significant majority of the workforce within the next decade.

Simultaneously, an AARP study indicated that 83 percent of employers believe creating a more multigenerational workforce will actively drive their success and growth. But the value of a multigenerational workforce goes beyond demographics. Different career stages bring different kinds of experience, knowledge, skills and perspectives to an organization. The opportunity for employers is not simply to manage those differences, but to create an environment where people learn from one another and where knowledge moves in both directions. Employers and employees working in the trenchless industry are navigating these changing dynamics every day.

To find out what is happening on the ground, NASTT asked primary contacts from organizational memberships:

"What have you learned about successfully working with or leading colleagues at different career stages and generations?"



"I have found success in dealing with different career stages and generations by encouraging questions and listening to these colleagues. As a seasoned 30+ year professional, I recognize the most important thing I can do for my organization and the industry is teach. Listen-teach-encourage."

- Tim McQueary, P.E., Vice President, HB Trenchless

McQueary's three-word approach may sound simple, but research shows that listening is an important leadership skill. The Center for Creative Leadership found in its report *Expanding the Leadership Equation: Developing Next-Generation Leaders*, that good listening helps people feel respected and builds trust. And direct reports across generations view supervisors that listen as better performers, someone they can learn from and motivate them to take actions that make an impact.



"I've learned that every generation contributes valuable perspectives. Experienced professionals bring deep knowledge and practical wisdom, Millennials offer a balanced view of business and broader stakeholder needs, and Gen Z provides clarity, confidence, and fresh thinking. Taking time to listen to different perspectives and apply them has made me a stronger leader and has consistently led to better decisions and outcomes for my internal team and for the industries we serve."

- Tiffanie Mendez, National Sales Director, Sunbelt Rentals Pump Solutions

A Deloitte study on how leadership focused on diversity of ideas, talent, customers and markets reshapes and influences business priorities. Curiosity is identified as one of six key traits of inclusive leaders. Mendez's open-mindedness and desire to understand how others view and experience the world is demonstrating this curiosity. Furthermore, she and her team are leveraging these perspectives in a way that results in better business decisions.



"In today's market, maximizing knowledge transfer between professionals at varying career stages is a foundational driver of organizational success. Senior experts can mentor junior engineers, accelerating their technical proficiency, while junior engineers bring proficiency with emerging digital tools. This reciprocal exchange provides junior engineers with hands-on technical training while senior engineers gain exposure to next-generation tools that can streamline project management workflows. Cultivating this exchange of expertise is vital for companies aiming to remain at the forefront of the trenchless industry amid rapid technological advancement."

- Kimberlie Staheli, Ph.D., P.E., President, Staheli Trenchless Consultants, Inc.

Deloitte's 2026 Gen Z and Millennial Survey ends with a similar challenge to employers to intentionally "evolve fast enough" by rethinking "how knowledge, capability and experience are built and sustained – not simply handed off." By examining how work is structured employers can meet the expectations, technical skills and adaptability of a new generation.



"Working with colleagues at different career stages has been most successful in seeing the different perspectives. People newer to the profession have great questions and challenge the "why" things are done in certain ways. People with many years in the profession typically want to share their knowledge and experiences. I try to pair people from these two groups on projects to ensure we are getting the best outcomes."

- Charles Pullan, P. Eng, Leader, Design and Annual Investment Programs, The City of Calgary – Utilities Delivery

Questions from newer professionals can also push experienced colleagues to think beyond how something has always been done and articulate why. Leadership author Simon Sinek popularized the idea of "starting with why," arguing that understanding purpose provides a stronger foundation for action. In a multigenerational workplace, asking "why" can serve another purpose as well: it can help distinguish practices grounded in valuable experience from those maintained simply because "that's the way we've always done it."

By intentionally pairing professionals at different career stages, organizations create space for both. Experience provides context for why certain practices developed, while fresh questions can challenge assumptions and open the door to new approaches.

What to Take Away

Overall research studies and trenchless leaders recognize that a multigenerational workforce isn't a challenge to manage. It's an organizational resource to use intentionally. A strong multigenerational organization gives people opportunities to learn from those who have already walked the road, while leaving room for the people coming behind them to question where that road should lead next.

From entry-level to mid-level managers to experienced executives, every employee has knowledge, ideas and untapped skills to contribute. Leaders who create a culture and community where the exchange strengthens both the people and the organization will be well-positioned for a successful future.

Resources

2025 Workforce Benefits Study (EY)

ey.com/content/dam/ey-unified-site/ey-com/en-us/insights/insurance/documents/ey-limra-workforce-benefits-study-final-2025.pdf

2026 Gen Z and Millennial Survey (Deloitte)

deloitte.com/global/en/issues/work/genz-millennial-survey.html

2016 The Six Signature Traits of Inclusive Leadership: Thriving in a Diverse New World (Deloitte)

deloitte.com/us/en/insights/topics/talent/six-signature-traits-of-inclusive-leadership.html

Creating an Intergenerational Employee Resource Group

(AARP)
employerportal.aarp.org/resource/guide-creating-an-intergenerational-erg/

Expanding the Leadership Equation: Developing Next-Generation Leaders (The Center for Creative Leadership)

ccl.org/wp-content/uploads/2026/01/developing-next-generation-leaders-research-paper-center-for-creative-leadership.pdf

From Starting Out to Standing Out

Young trenchless professionals reflect on early challenges, career growth and finding their place in the industry.

By: Carolyn Hook, Membership Outreach & Database Manager

Every career starts with a learning curve. In trenchless, that curve can feel particularly steep.

In a highly specialized industry like trenchless, that curve can mean encountering technologies never covered in school, translating academic knowledge into real-world projects, establishing credibility and simply figuring out where you fit.

We reached out to young professionals who have already made their mark on the trenchless community. Each has been recognized by NASTT for achievements at different stages of their early careers, either as a Trenchless Rising Star or a recipient of the Ralston Young Trenchless Achievement Award. We asked them to reflect on the challenges they've encountered, what they need to continue growing and what they value about the journey so far.



Mitchell Spence, EIT - Project Coordinator

Michels Canada

Age: 24 | Years in Trenchless: 4

"I think the most important thing is to continue learning after graduating." Whether through experiences, projects or coursework, Mitchell understands that growth doesn't just happen. To understand the technologies that professionals use every day, best practices and where the industry has come from, Mitchell recommends technical papers and resources from NASTT Knowledge Hub.



Simon Baeza-Faundez, MS, EIT, Tunnel and Trenchless Engineer

Stantec

Age: 33 | Years in trenchless: 4

"When I first started, the most challenging part was realizing how much I did not know." Acknowledging that it has taken time to learn the wide the range of trenchless technologies and the specific applications for each, Simon said, "I will probably never stop learning." And today that dedication to learning and the support of an experienced team of engineers has allowed him to be able to take ownership of projects with confidence.



Paige Gilliam, Engineer

GHD

Age: 27 | Years in trenchless: 4

Paige remembers arriving at her first NASTT conference not knowing anyone and feeling overwhelmed by the unfamiliar technologies, products and construction methods. But as she continued attending, unfamiliar faces became familiar ones, including many of the same people she turned to for advice on projects. What surprised her most was “how collaborative the trenchless community is.” Today, she values being part of that network and has discovered that “simply raising your hand to volunteer can quickly lead to meaningful relationships with some of the most knowledgeable professionals in the industry.”



Madelyn Smith, Intermediate Geotechnical Engineer-In-Training

CCI Inc

Age: 26 | Years in trenchless: 4

As a student, Madelyn benefited from NASTT scholarships that allowed her to attend No-Dig conferences, build industry connections and become involved in the trenchless community. Those opportunities are especially important early in a career, when young professionals are building the knowledge and relationships that will help shape their future. Yet conferences are often more heavily attended by established professionals who already have strong networks and business development opportunities. “My scholarship experiences with NASTT have been extremely valuable in my development. Creating similar opportunities for young professionals would help keep the next generation engaged in the trenchless community.”



Jacob Klingaman, Principal Engineer

Hazen and Sawyer

Age: 30 | Years in Trenchless: 4

“I think the most helpful growth catalyst at this point in my career is having good mentoring and guidance. For Jacob, working in a specialized field like trenchless means there isn't always an obvious roadmap for an early-career professional. Learning from seasoned professionals can provide perspective on industry trends, needs and opportunities that comes only with experience.”



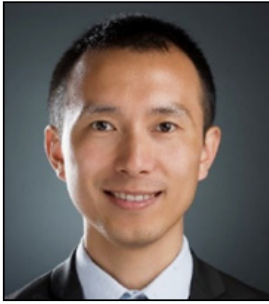
Zahra Joneidi, Ph.D. Municipal Engineering Specialist

AECOM

Age 34 | Years in Trenchless: 5

“My Ph.D. gave me a technical foundation in trenchless rehabilitation, and now I want to continue building my experience in design, construction, project management, and client communication.” Zahra recognizes the importance of connecting her technical background with real-world project delivery, valuing opportunities to take on increasing responsibility and learn from experienced professionals to fuel her ongoing growth.

Trenchless Career Development



Chao Kang, Senior Geotechnical Engineer
WSP Canada, Inc.

Age: 40 | Years in trenchless: 10

For Chao, professional growth has meant moving from research into real-world application and, increasingly, giving back to the community that helped him grow. "When I first entered the industry, the biggest challenge was translating my research experience into practical engineering solutions and communicating those solutions confidently with clients and contractors. Today, the most rewarding part is being able to provide consulting services to clients while staying connected with the broader trenchless community." His involvement with the NASTT Northwest Chapter now gives him an opportunity to give back to the community that supported his professional development.



Inshik Park, MSc, CTech, Tunnelling & Trenchless Designer / PhD Candidate
AECOM / University of Alberta

Age: 38 | Years in trenchless: 8

While research has been front and center for Inshik, he was always looking to see the practical applications. "I was very unsure whether my research would be meaningful to industry practitioners," he said. Instead, he found many interested trenchless professionals who were "very creative and open-minded." He began to build relationships that led to collaborations and his new role at AECOM where he looks forward to "real-world projects" and learning from experienced professionals with wide range of technical experience to build on his Ph.D. studies.



Kyle Friedman, PE, Rocky Mountain Trenchless/Marketing Lead
Brierley Associates

Age: 32 | Years in trenchless: 8

"Drinking from a firehose" is how Kyle described the early parts of his career. "There was so much to learn in a short amount of time, from understanding the technologies themselves to learning how they were applied in the field." He had opportunities to learn from contractors and industry professionals across the country and today he is able to leverage that knowledge to contribute at a higher level, solve more complex problems and help mentor team members. While ongoing learning remains a key part of his development, the most rewarding part of his career today is "seeing the bigger picture of how our work impacts clients and communities."



Amin Tehrani, PhD, PE, PACP, Wastewater Conveyance Program Manager
North Texas Municipal Water District

Age 35 | Years in Trenchless: 9

"The hardest part of entering the industry early was establishing credibility while still being one of the younger people in the room. I learned quickly that credibility does not come from your title or age; it comes from being prepared, asking good questions, taking responsibility, and consistently delivering." Today, Amin values the opportunity to give back to the industry and professional organizations that helped shape him. His progression has shown that sustained involvement can create opportunities to contribute and influence the industry early in a career.

Different paths brought these young professionals to where they are today, but common threads run through their stories: continuous learning, growing responsibility, meaningful professional relationships and a willingness to get involved. Perhaps most encouraging is the collaborative trenchless community they describe, where knowledge is shared, questions are welcomed and professionals at every career stage have something to contribute.

Make Membership Matter

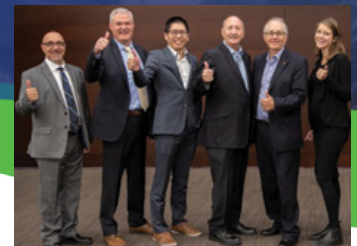
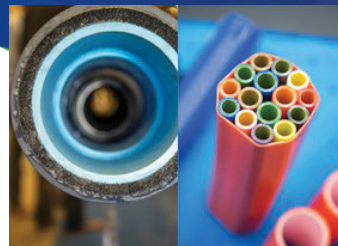
- **Develop your people** through technical education, training and shared learning opportunities.
- **Connect your employees to the trenchless community** and the people, ideas and experiences that can help them throughout their careers.
- **Make membership easier** with group rates and simplified membership management for your participating employees.
- **Stay connected to industry insights** with In Touch for organizational members.
- **Access trenchless knowledge and solutions** from the industry's founders, innovators, experts and front-runners.
- **Increase your organization's visibility** through the Trenchless Industry Directory of NASTT Organizations and recognition as a NASTT group member.
- **Expand your industry presence** with member-only exhibitor rates at the NASTT No-Dig Show and NASTT No-Dig North. PLUS 2 free job postings in the NASTT Trenchless Career Center.
- **Invest in your employees** with access to the NASTT Knowledge Hub and bulk purchase rates on NASTT books.
- **Strengthen your employee benefits** by giving your people opportunities to build knowledge, relationships and a sense of belonging within their profession.
- **Be part of something bigger** by supporting the community working together to advance trenchless technology.

Our group members bring people together to learn, connect and contribute – strengthening the NASTT community and the trenchless industry we share.



Bring more to your career.
Save time and money.

Empower the world of trenchless technology.



Be part of the premier network of trenchless professionals.

NASTT members have worked through challenges, celebrated success and are ready to share their know-how at events, volunteer activities and online.

Be a solution provider.

Whether you're just starting out or are in the C-suite, NASTT's exclusive education and training supports your certification goals, grows your skillset and brings answers to your project, job site, team meeting and KPIs.

Be on the front lines of trenchless issues and products.

NASTT brings you emerging trends, innovative technologies, and who's who in the profession so you can keep up to date on the information you need to stay on the cutting edge of the industry.

Be the best with support from the best.

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NASTT Group Members

Belonging is being part of a community that shares your commitment to the industry.

NASTT proudly recognizes our Corporate and Government, Utility and Education group members for their ongoing support of NASTT and their commitment to advancing trenchless technology. These organizations *and the people within them* help strengthen the connections, knowledge and shared experiences that move our industry forward.

Primary contacts for these group memberships are included in the following listing. To connect with individual NASTT members, log in to your NASTT profile to access the NASTT Member Connect Directory.

The member lists are as of August 2026. **Commercial solicitation is prohibited.**

Belong Together. Grow Together.

NASTT group membership makes it easier to bring your people into the trenchless community, giving employees across your organization opportunities to build knowledge, make connections, share experiences and grow through NASTT.

GROUP MEMBERSHIP AT A GLANCE

NO EMPLOYEE LIMIT

Include as many employees as you choose.

FLEXIBLE PRICING

A base membership includes a set number of employees; add more at the individual group-member rate.

INDIVIDUAL MEMBER PROFILES

Each participating employee has their own NASTT login, profile and member access.

ONE ORGANIZATIONAL MEMBERSHIP

Include employees from multiple locations under one organizational membership.



Corporate Members

Any North American corporation, partnership or individual doing business as a sole proprietorship. Corporate membership has no limit on the number of employees who may be included. The base membership includes six employees, with additional employees added at the individual group-member rate. Subsidiaries with their own U.S. Federal Employer Identification Number (EIN) or Canadian Business Number (BN) are required to maintain separate corporate memberships.



Aaron Enterprises, Inc.
Tom Rice, Territory Manager
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See ad on pg. 47

Ace Pipe Cleaning, Inc.
A Carylton Company
Ryan Poertner,
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Trenchless Rehab Division
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Acoustical Control, LLC
Clayton Cox, Regional
Account Manager
acousticalcontrol-llc.com

Adtech Motors
Casey Ross, Technical Sales
adtechmotors.com

AECOM
Paul Nicholas, Trenchless
Market Sector Manager
aecom.com



Akkerman
Jason Holden, CRO, VP,
Chief Revenue Officer
akkerman.com
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Alliance for PE Pipe
Peter Dyke, Executive Director
pepipe.org

American West Construction
Paul Snyder, Manager
trustawc.com

AOC
Mike Diehl, Director of
Marketing, Americas
aocresins.com

Arup (Toronto, Canada)
Ash Colls, CE, Senior Designer
arup.com

Associated Engineering
Jason Lueke, Ph.D., P.Eng.,
National Discipline Leader -
Trenchless
ae.ca



**Astec | Elgin Separation
Solutions**
Raymond Pietramale,
Equipment Manufacturer,
Director of Marketing
elginseparationsolutions.com
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Atlas Trenchless, LLC
Jim Lagios, President/
General Manager
atlas-trenchless.com
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Avanti International
Jessica Williams, Director of
Marketing & Communications
avantigrout.com

Avertex Utility Solutions Inc.
Jason Kottelenberg, President
avertex.ca

Azuria Water Solutions
Beth Kerley, Vice President,
Communications
azuria.com

Barbco Inc.
Sara Barbera, Marketing
barbco.com

Benjamin Media Inc.
Kelly VanNatten, Publisher
benjaminmedia.com

Bennett Trenchless Engineers
Kathryn Wallin, Senior Scientist
bennetttrenchless.com

BGC Engineering Inc.
Jeremy Groves,
Senior Geotechnical Engineer
bgcengineering.ca

**Big River Trenchless and
GeoServices**
Jim Lamb, Director of
Operations
bigrivergeo.com

Bit Brokers International
Chester Thomas, In House
Counsel And Sales Rep
bitbrokers.com

Bolton & Menk, Inc.
Brian Simmons, PE,
Principal Engineer
bolton-menk.com

Bore Master Inc.
Ryan Haubenschild,
Vice President
globecontractors.com

Boretac LLC
Dave Gasmovic,
Business Development Manager
boretac.com

**Bradshaw Construction
Corporation**
Eric Eisold,
Executive Vice President
bradshawcc.com



Brandt Industries USA Ltd.
Subi Vaid
Sales & Marketing
www.brandt.ca
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**Brierley Associates
Corporation**
Nick Strater, PG,
Sr. Project Manager
brierleyassociates.com
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Brown and Caldwell
Christopher Garrett
brownandcaldwell.com

Brownline Canada
Mohammed Al-Wazir, EIT,
Country Operations Manager
www.drillguide.com

Brownline USA
Robert Cloud,
Operations Manager
drillguide.com/en

BT Construction
Chris Knott, Director Of
Business Development/
Estimator
btconstruction.com

Burns & McDonnell
Branako Primm, PE,
Technical Consultant
burnsmcd.com

Campos EPC, LLC - HQ
Ryan Wamble, Director of
Engineering, Pipeline
camposepc.com

Capital Infrastructure Group
David Beswick, President
capitalinfrastructuregroup.ca

Carollo Engineers, Inc.
Tim Taylor,
Infrastructure Practice Director
 carollo.com

Carylon Corporation
Theresa Calvert, Vice President
 caryloncorp.com

CCI & Associates, Inc.
Justin Taylor, P.Eng., PE, VP of Engineering / General Manager
 cciandassociates.com
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CETCO - Minerals Technologies
Debra Bac,
Technical Sales Manager
 cetco.com/dpg

CHA Consulting, Inc.
Jeff O'Donnell, Vice President
 chasolutions.com



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CJGeo Contractors
James Corbin,
Territory Manager
 cjgeo.com



Claude H. Nix Construction
Stephanie Nix-Thomas,
President
 chnix.com
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Consor Engineers
Brendan O'Sullivan, PE,
Technical Practice Leader,
Trenchless Technologies |
Principal Engineer
 consoreng.com
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Contech Engineered Solutions LLC
Gaelyn S. Cunningham,
Senior Marketing Manager -
Pipe Solutions
 conteches.com
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Core & Main
Cheryl Rhude, Sr. Director –
Fusible Infrastructure Solutions
 coreandmain.com

CoreAqua
John Deziel, US Sales Manager
 coreaqua.com

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Migdalia Gonzalez,
Sales Administrator
cuesinc.com

D.V.M. Utilities, Inc

Daniel DiLegge, President
dvmutilities.com

Delve Underground

Glenn Boyce, Ph.D., PE, P.Eng, Jr,
Principal
delveunderground.com

Derrick

Ben Clark, Global Sales Manager
- Civil
derrick.com

Digital Control Inc.

Siggi Finnsson,
Sr. Product Manager
digital-control.com

Doetsch Environmental Services

Joe Schotthoefer,
Vice President
doetschenvironmental.com

Dresser Utility Solutions

Leigh Ramirez,
Senior Marketing Manager
dresserutility.com

Dycom Industries

Sam Shields, Vice President
Fleet & Facilities
dycomind.com

Dynamic Downhole Innovations

Travis McCartney,
Founder & CEO
dynamicdownhole.com

EB Trenchless

Troy Linton, P.Eng., President
ebtrenchless.ca

Ecopoly Tech, Inc.

Gareth Cong,
Marketing Manager
socochem.com

Edge AI Solutions, Inc.

Renata Seneca, EA,
Office Manager
edgeaisolutions.com

Ellingson Companies

Rob Hotz, General Manager
ellingsoncompanies.com

Emagineered Solutions, Inc.

Steve Waring,
Chairman and CEO
emagineered.com

Engineering & Construction Innovations, Inc. (ECI)

Chris Kester, Chief Estimator
eciconstructors.com

Environmental Noise Control

Matt Cott, Director of Business Development
environmental-noise-control.com

ENZ USA Inc

Lance Pusey, North American Sales Director
enz.com/en/home

Faction Fusion

Robert Morrow, President
factionfusion.com

Ferreira Construction Co., Inc.

Brandon Pensick,
Senior Vice President
ferreiraconstruction.com

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Carleton Sherrer, PE, DBIA,
Principal/Vice President |
Technical Excellence Director
freese.com

Garver

Maureen Carlin, Ph.D.,
Trenchless Pipeline and Utility
Tunneling Practice Leader
garverusa.com

GEI Consultants, Inc.

Benny Siljeborg, PE, MBA,
Vice President
geiconsultants.com

GeoEngineers

Jon Robison, Principal
geoengineers.com

GHD

Aaron Bruce, Sr. Project Manager/Trenchless & Rehabilitation Team Lead
ghd.com

Global Materials Company

Jason Parent, Facility Manager
globalmaterialscompany.com

Haley & Aldrich Inc. - Corporate Office

Carrie Layhee, P.E., Senior Associate | Geotechnical Engineer
haleyaldrich.com

HammerHead Trenchless Equipment

Jeff Gabrielse, GM/President
hammerheadtrenchless.com

HardRock Infrastructure Services

Donna Kurz, Manager
hardrockis.com

Haugland Group

John Seibert, Vice President,
Trenchless
hauglandgroup.us

Hazen and Sawyer

Sean O'Rourke, Engineer
hazenandsawyer.com

HB Trenchless, LLC

Timothy McQueary, PE,
Vice President
hbtrenchless.com

Henkel Corporation

John Hepfinger, Head of Water & Civil Infrastructure
henkel.com

Herrenknecht Tunneling Systems

Gerhard Lang, Ing., Business Development Manager
herrenknecht.com/en

HOBAS Pipe USA

Lia Chowdhury,
Marketing Coordinator
hobaspip.com

Hoerr Construction Inc.

Andrew Hoerr, Vice President
hoerr.com

Holly Pipe Corp.

Jerry Nugent, President
hollypipe.com

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HTS Pipe Consultants Inc.

Tom Schultz, President
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John Langford,
Operations Manager
huxtedtrenchless.com

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Guido Pellegrino, President
icopgroup.com

Imerys

Joseph Talley, Americas Area Infrastructure Manager
imerys.com

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Marketing & Communications
impreg.com

Infrastructure Intelligence Services Inc.

Paul Fleischer, B.Sc., President
i2sinc.ca

Infrastructure Rehabilitation USA, Inc.

Noah Baker, CAO and General Counsel
irehabusa.com

Innovations Amplified

Susan Kay Watkins, Marketing & Brand Development
innovationsam.com

Interplastic Corp.

Jason Schiro, Business Manager- Pipeline Remediation Polymers
interplastic.com

Interstate Engineering, Inc.

Bryan Tuss, Senior Project Manager
interstateeng.com



Iowa Trenchless

Jason Clark, President/Owner
iowatrenchless.com
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IPEX, Inc.

Rodney Johnston, Trenchless Solution Specialist - Canada
ipexna.com

IPP Solutions, LLC

Joerg Kruse, Managing Director
ippsolutions.com

IVIS Inc.

Dolores Eaton, President
ivisinc.com

J. D. Hair & Associates, Inc.

Jeff Puckett, President
jdhair.com

J. Fletcher Creamer & Son, Inc.

Jason Newman, President
jfcson.com



"I stumbled into the trenchless industry through my role in the public sector where there is a constant pursuit of minimizing disruption to the public and improving customer service levels. Anyone entering the trenchless industry can keep abreast of advancements through NASTT resources such as publications and conferences."

– Kristy Gibson, Project Coordinator, City of Toronto, Toronto Water - Laboratory Services

J.W. Fowler

John Fowler,
Chief Operations Officer
jwfowler.com

Jacobs Engineering Group - World HQ

Matthew Tooley, CPEng,
Principal Civil & Water Engineer
jacobs.com

JD Brule Inc.

Valerie Brule, Accountants Payables
jdbrule.com

JIREH

Randy Sneep,
Marketing Coordinator
jireh.com

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Sarah King, PE, PMP, LEED AP,
Principal Civil Engineer
kennedyjenks.com

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Forest Rong, Vice President,
Power Delivery
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Kiewit Infrastructure Co.

Matt Roberts,
Trenchless Manager
kiewit.com

Kimley-Horn and Associates, Inc.

Marty Paris,
Senior Vice President
kimley-horn.com

Kleinfelder

Gus O'Leary, Principal Professional
kleinfelder.com

Kondex Corporation

Diane Riley, Marketing
kondex.com

Laney Directional Drilling Co.

Andrew Sparks,
Director of Engineering
laneydrilling.com

LaValley Industries

Jorge Prince,
Chief Financial Officer
lavalleyindustries.com

LJB Engineering Inc.

Ashley Huntsberry,
Marketing Coordinator
aldeaservices.com

Logan Clay Products

David Gill, Sales Engineer
loganclaypipe.com

Logiball Inc.

Patrick Plourde, President
logiball.com

M.E. Andrews and Associates

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Diane McLean, CPM,
Office Manager
andrews.engineer

Master Builders Solutions

Ed Paradis, Sales and market Development Manager Injection Systems, North America
master-builders-solutions.com

Memphis Road Boring

Thomas Sander, President
memphisroadboring.us

MetaFLO Technologies

Giovanna Sera,
Director of Global Marketing
metaflo.tech

Michael Byrne Manufacturing

Jim Weist, President
byrnegroup.com



Michels Canada

Dave DeJong,
Director, Heavy Civil
michelscanada.com
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Michels Corporation

Matt Smith, President
michels.us
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"I joined because with municipalities' underground infrastructure coming to its end of design life during a time when municipalities are consolidating and have limited capital budgets, the only solution to keep things flowing is via trenchless methodologies. NASTT is the place to be – the place to obtain the knowledge necessary to support our municipalities into the future."

– Greg Tippet, Principal - Regional Delivery Lead, Stantec



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David Howell, Director of Rail
& Consulting Services
midwestmole.com
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Curt Dubbin,
Construction Division Manager
mincon.com


Minger Construction Co., Inc.
Luke Minger, President
mingerconstruction.com

Mladen Buntich
Construction Co., Inc.
Lee Roesner, PE, Vice President
buntich.com

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Mark Ramsey, North America
Tunnels Practice Lead
mottmac.com

MSH Engineers
Hamdi Hamad, President
mshe.us

NO-DIGTEC, LLC
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pipeburster.com

Norditube North America
Robert Hinckley,
EVP Sales & Marketing
norditube.com

Northeast Remsco
Construction Inc.
Richard Palmer,
Vice President, Trenchless
northeastremSCO.com

NorthStar Fluid Solutions
Jon Todd, Supply Chain
Manager/Co-Owner
northstarfluids.com

Novinfra
Alexandre Bouchard, VP
operations / Co-Founder
novinfra.com

NuFlow/Trelleborg
Marissa Melanese,
Projects Coordinator
nuflowtechnologies.com



OBIC
Mike Hoffmaster, Vice President
Business Development
obicproducts.com
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Omega Liner Company, Inc.
Melody McConnell,
Sales & Marketing Specialist
omegauvpipe.com

ParklandGEO Ltd.
Monique Tenszen,
Geo-Environmental Engineer
parklandgeo.com

Pate Garver, LP
David Ellett, Vice President
pategarver.com

Path Power
Shawn Burns,
Head of Business Development
path-power.com


PICA Corporation
Dave Russell,
President
picacorp.com

Picote Solutions Inc.
Katja Lindy-Wilkinson, CEO
picotesolutions.com


Plastics Pipe Institute
Camille Rubeiz, PE, F. ASCE,
Senior Director Of Engineering
plasticpipe.org
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PLG Technologies
Brian Sherrell,
Product Development
plgtech.us

Precision Boring
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Daniel Smith, Vice President
linkedin.com/in/daniel-smith-
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Jennifer Mabrey,
Operations Manager
PREDL.us

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Michael Vargo,
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Albert Apicella, MBA, Director
of Business Development
progressivepipe.com

Protective Liner Systems, Inc.
Jerry Trevino, President
protectivelinersystems.com

PSILAB, Inc.
Danny Villarreal,
Laboratory Manager
psilab.net

PW Trenchless
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Marcelo Zen Nakashima,
Project Manager
pwtrenchless.com

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George Gerz,
Senior Technical Sales Manager
primusline.com



Rain for Rent
Tasha Grahek,
Marketing Manager
rainforrent.com
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Gregory Hall, President
rauschusa.com

RedZone Robotics Inc. - HQ
Christopher White,
Vice President of Data Services
redzone.com

Reline America LLC

Jeff van Huet, Technical Advisor
relineamerica.com

RJN Group

Zachary Matyja, PE, Vice President of Client Services
rjn.com

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Charlie Kuhnmuensch, Vice President
sakcon.com

Schellvac Equipment Inc

Alexander Gottfried, Marketing & Sales
schellvacequipment.com

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schnabel-eng.com

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Blair Seeley, Principal
scsconsultinggroup.com

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Pam Sawatzke, Sales/Marketing
sssealingsystems.com

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Chris Lind, General Manager, Sales & Engineering
sekisui-spr.com

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Chuck Skillman, Operations Manager
sentinel-solutions.com

Sewer Equipment Company of America

Carlos Vargas, Marketing Specialist
sewerequipment.com/#

SewerAI Corporation

Mairen Magee, Field Marketing & Social Media Coordinator
sewerai.com

SFE Global

Mike Lemmen, Director
sfeglobal.com



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Danmeng Qian, Engineer
scg.com.cn

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Paul Trautmann, Regional Director of Water & Wastewater
sherwin-williams.com

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Giacomo (Jack) Conte, CEO
sippamericas.com

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Kate Stephenson, Technical Sales Manager
s1online.com

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Tim Bako, Vice President of Corporate Strategy
spiniello.com

SprayRoq Inc.

Anthony Hughes, PE, Director of Business Development & Technical Services
sprayroq.com

SSC Underground

Arvid Veidmark, President
sscunderground.com

Staheli Trenchless Consultants

Kimberlie Staheli, PE, Ph.D., President
stahelitrenchless.com

Stantec

Matthew Devitt, P.Eng., Civil/Conveyance Engineering Discipline Lead - Senior Trenchless Engineer
stantec.com

Stiver Engineering, Inc.

Sarah Vandiver, Marketing Coordinator
stiverengineering.com

Strack, Inc.

Trey Bradbury, Sr. Estimator
strackinc.com



Sunbelt Rentals, Inc.

Tiffanie Mendez, National Sales Director
sunbeltrentals.com
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Tanner Pacific, Inc.

Amelia Wheeler, Business Manager
tannerpacific.com

TCI Carbon Fibre Technologies

Ken Auty, VP of Sales
tcicarbonfibre.com

Tele-Vac Environmental

James Kratochvil, Operations Manager
tele-vac.com

Terracon

Sam Brancheau, PE, PG, Project Engineer - Geotechnical Services
terracon.com



The Crossing Company - The Crossing Group

Ryan Maclean, CEO
crossinggroup.com/the-crossing-company
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The Driller, LLC

Scott Dullard, General Manager
thedrillerllc.com

The Haartz Corporation

Lance Cullen, Business Development Manager
haartz.com

The Hallen Construction Company, Inc.

James Small, Vice President Purchasing
hallen.com

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Kimberly Yontz, Winston Salem, NC, President
thepipeboss.com

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Carl Pitzer, PE, Director
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Director of Epoxytec
tnemec.com

Trenchless Rental Solutions
James V. Barbera,
Sales Manager
trs.rent

TRUVAC by Vactor
Manufacturing, Inc.
Kristy Gussarson, Marketing
truvac.com

TRY TEK Machine Works Inc.
Dennis Burger, Vice President
trytek.com

TT Technologies, Inc.
Chris Brahlner, President/
Chief Executive Officer
tttechnologies.com

TuffRod Pipe Company
Jim Kavadas, Pipe Specialist
tuffrod.com

Underground Magnetics Inc.
Michael Young, President
undergroundmagnetics.com

Underground Tools Inc.
Al Chancellor, Marketing/Sales
undergroundtools.com

Uni-Jet Industrial Pipe Services
Ryan Slagerman,
Operations Manager
unijet.ca

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McKenna Goodman,
Director of Marketing
vac2go.com

Vac-Con, Inc.
Christopher Smith,
Vice President, Marketing
vac-con.com



Vector Magnetics
Jed Sheckler,
Director of Marketing
vectormagnetics.com
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Vermeer Corporation
Amy Olsen, Product Marketing
Lead - Utility & Pipeline
VermeerMVS.com

Victoria Drains
Adam Holcombe,
General Manager
victoriadrains.com

Vortex Companies
Kit Jones, VP,
Marketing Communications
vortexcompanies.com

Wade Trim
Donna Jakubowicz, FSMPS,
CPSM, Vice President,
Director of Brand
wadetrim.com

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Victoria Messina,
Marketing Manager
warrenenviro.com

Westerra Equipment Ltd
Brad Wiebe, Sales Manager
westerraequipment.com

Westlake Pipe & Fittings
Keith Moggach,
National Manager -
Specification Engineering
westlakepipe.com

WSB
Justin Messner,
Director of Municipal Services/
Principal
wsbeng.com

Xylem Dewatering
Solutions, Inc.
Jason Miller, Business
Development - Infrastructure
xylem.com

Yogi Kwong Engineers, LLC
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awwd.com

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Director of Engineering
arrowutilities.ca

Central Contra Costa Sanitary District
Sasha Mestetsky,
Senior Engineer
centralsan.org

City and County of Denver | Department of Transportation and Infrastructure (DOTI)
Hector Lujan,
Wastewater Construction Supervisor
denvergov.org

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Jason Suhr, Principal Engineer
bendoregon.gov

City of Columbus, Department of Public Utilities
Michael McCloud,
Engineering Associate III
columbus.gov

City of Edmond
Kenneth Miner, Engineering Inspections Supervisor
edmondok.com

City of Garland
Vishal Sood,
Water/Wastewater Capital Projects Director
garlandwater.com

City of Littleton
Madison Tenney,
Business Support Specialist
littletongov.org

City of Medicine Hat
James King,
Construction Superintendent
medicinehat.ca

City of Moscow, ID
Brian Bontrager, Engineering Manager/City Engineer
ci.moscow.id.us

City of New Bedford - Department of Public Infrastructure
Jamie Ponte, Commissioner of Public Infrastructure
newbedford-ma.gov

City of Newport Department of Utilities
Robert Schultz,
General Manager & Chief Engineer Utilities
cityofnewport.com/utilities

City of Omaha Public Works
Chris Driscoll, Civil Engineer
publicworks.cityofomaha.org

City of Ottawa
Alexandra Grant, Program Lead
ottawa.ca/en

City of Pacifica
Rey Mendez,
Collection System Manager
cityofpacificca.org

City of Palo Alto
Nelson Schlater,
Principal Engineer
cityofpaloalto.org

City of Portland Environmental Services Bureau
Amber Clayton, Collections System Division Manager
portlandoregon.gov/bes

City of Regina
Allison Hahn, Senior Water and Wastewater Engineer
regina.ca

City of Renton
Joe Stowell, Wastewater Utility Engineering Manager
RentonWA.gov

City of Richmond
Roger Keating, ASCT,
Project Manager
richmond.ca

City of Saint John
Chris Sanford, Superintendent
saintjohn.ca

City of St. Albert
Micah Seon-King, PMP,
Project Manager | Utilities Branch, Public Operations
stalbert.ca

City of Victoria
Derk J Wevers, ASCT,
Supervisor - UG Utility Infrastructure Design
victoria.ca

Clean Water Services
Wade Denny, Conveyance Engineering Division Manager
cleanwaterservices.org

County of Santa Cruz
Ashleigh Trujillo,
Senior Civil Engineer
cdi.santacruzcountycalifornia.gov/PublicWorks.aspx

Delaware County Regional Sewer District
Nathan Givens, PE,
Construction Manager
regionalsewer.co.delaware.oh.us

Denver International Airport
Catherine Rafferty,
Senior Engineer
flydenver.com

Denver Water
Drew Randall, P.E., Senior Water Distribution Engineer
denverwater.org

Ductile Iron Pipe Research Association (DIPRA)
Sam Ghosn, MSc, P.Eng,
Regional Engineer
dipra.org

EPCOR
Chaoshi Hu, PhD, P.Eng., PMP,
Project Manager
epcor.com

EPCOR Water Services - Linear Asset Engineering
Jenna Cunningham,
Associate Director,
Linear Asset Engineering
epcor.com

Great Lakes Water Authority
Jason Edberg, PE, MBA,
Director of Infrastructure Special Projects
glwater.org

Greenville Utilities
Scott Farmer, PE, Water Resources Systems Engineer
guc.com

Gull Lake Sewer & Water Authority
John Crumb, Executive Director
glswa.org

Los Angeles County Sanitation Districts
Samuel Espinoza,
Department Head
lacsdsd.org

**Louisiana Tech University/
Trenchless Technology Center**
John Matthews, Ph.D., TTC
Director
latech.edu

Metropolitan Council
Carol Blommel Johnson,
Assistant Business Unit
Manager
metrocouncil.org

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Greater Chicago (MWRDGC)**
Lou Storino, P.E., BCEE,
Managing Civil Engineer
mwrdd.org

**Milwaukee Metropolitan
Sewerage District**
Bridget Henk,
Principal Project Manager
mmsd.com

**Murfreesboro Water and
Sewer Dept**
Valerie Smith, Assistant
Director of Engineering &
Compliance
murfreesborotn.gov

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Sheila Joy, Executive Director
nassco.org

National Grid
Jesse Lubbers,
Principal Project Manager
nationalgrid.com

**Niagara Region - Water &
Wastewater, Public Works**
Greg Epp, Supervisor
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Challenging HDD Crossing in Northern Alberta: NPS 48 Product Pipe Installation with over 230 ft in Elevation Change

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1.0 ABSTRACT

TC Energy recently completed a challenging NPS 48 pipeline crossing of the Simonette River in Northern Alberta, using an HDD Intersection Method. TC Energy retained the services of Blue Fox Engineering for engineering design, The Crossing Company for the HDD Installation as well as various other services such as inspection (CCI), drilling fluid



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1. ABSTRACT

TC Energy recently completed a challenging NPS 48 pipeline crossing of the Simonette River in Northern Alberta, using an HDD Intersection Method. TC Energy retained the services of Blue Fox Engineering for engineering design, The Crossing Company for the HDD Installation as well as various other services such as inspection (CCI), drilling fluid management, and a drilling fluid consultant all with specialty in large diameter crossings. The installation was over 1190m (3900ft) long with an elevation change of over 70m (230ft) between entry and exit locations. This paper summarizes the design and construction challenges that the project faced as well as different mitigations planned and used for the crossing.

Design challenges included right-of-way constraints, large elevation differences, significant steep slope directly adjacent the water crossing, large floodplain at the lower elevation, soils including sands and gravels, bedrocks with numerous coal seams and bedrock strengths, as well as the potential for water bearing features in the upper slope. HDD, Direct Pipe, and Open Cut options were all evaluated for this crossing however due to the right-of-

This paper is among those that received an outstanding score in the abstract review process, among all the presentations at the 2026 NASTT No-Dig Show in Palm Springs, CA. NASTT No-Dig Papers are available for download, free to members, at www.nastt.org

way constraints and significant slope the HDD was selected as the preferred crossing methodology.

Construction challenges included flooding of the entry location, casing installation requiring 10m (30ft) of penetration into the bedrock formation, multiple drill pipe breaks, a 60-inch reamer abandoned downhole, a new partial alignment deviating from the existing borehole, a direct pipe thruster to assist with the upper portion of the pipe installation during pullback, and a smaller than typical bore diameter on the upper slope.

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Figure 1. Simonette River Crossing Location

2.0 INTRODUCTION

TC Energy Corporation (TC Energy) recently installed an NPS 48 pipeline beneath the Simonette River as part of the Grande Prairie Mainline Loop No.2 Project. The crossing design went through various iterations of different methodologies before settling on an HDD intersect methodology. Direct Pipe and Open Cut options were also evaluated for this crossing however due to the right-of-way constraints and significant slope including the complexity of opening the steep slope adjacent to the river, the HDD methodology was selected as the preferred crossing method.

3.0 SITE AND GEOTECHNICAL CONDITIONS

The crossing is located approximately 90km Southeast of Grande Prairie, AB (Figure 1). The crossing alignment is surrounded by several foreign utilities, powerlines, access roads, crown land, and other TC Energy owned infrastructure.

The river meanders within a valley bottom approximately 1,000m (3280ft) wide and is located directly adjacent to a steep slope to the southeast side. The slope starts with a

grade greater than 1:1 for approximately 35m (115ft) and gradually reaches top of bank 74m (243ft) above the river water level.

Multiple studies including geotechnical investigations, hydrology and scour analysis, landslide hazard assessments, as well as geophysics were conducted at the crossing site between January 2019 and April 2022.

The geotechnical program consisted of 11 boreholes drilled along the alignment varying in depth to help assess both the open cut and trenchless option. For the

HDD, 7 of the 11 boreholes were relevant for assessing the viability of the HDD Crossing. The locations of the boreholes completed along the HDD alignment are shown in Figure 2. Boreholes were drilled using a track mounted drill rig capable of solid stem auguring, ODEX, and HQ Coring, and HQ Coring with tricone drilling.

Based on the available geotechnical information, the northwestern site conditions near HDD entry location consisted of approximately 5 to 6m (16 to 20ft) of sandy gravel, sandy silty clay, and



Figure 2. HDD Alignment and Borehole Locations

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silty clay. The consistency of these soils ranged from loose to compact and very soft to soft. Beneath the soils bedrock was encountered and comprised of alternating layers siltstone, mudstone, and sandstone. Overall, the first 6m (16ft) of bedrock were completely weathered and extremely weak to weak. After this transition zone the bedrock quality and strength improved and had an overall Rock Quality Designation (RQD) average of 92, and was described as primarily as extremely weak to very weak. The unconfined compressive strength ranged from 2.3 to 58.5 MPa (0.3 to 8.5ksi) for the bedrock layers.

The southwestern site conditions near the HDD exit location consisted of approximately 12 to 16m (39 to 52ft) of sandy silty clay, sandy clayey gravel, gravelly clayey sand with inferred cobbles and boulders, and gravel with inferred cobbles. The gravel layer located just above the bedrock was over 5m (16ft) thick vertically. The consistency of these soils ranged from stiff to very stiff and compact to dense. Beneath the soils, bedrock was encountered and comprised of alternating layers mostly siltstone and sandstone, with the occasional layers of mudstone. Numerous thin layers of coal were observed within the first 12m (39ft) of bedrock beneath the overburden. The RQD in the closest borehole to the exit location had an average of 48, while the RQD improved northwest of the exit location with an average of 74. Overall, the bedrock was described as highly weathered to moderately weathered and extremely weak to medium strong. The unconfined compressive strength ranged from 17.5 to 18.3 MPa (2.5 to 2.7ksi) for the

bedrock layers. Zones of fluid loss and no recovery were encountered at various locations.

Beneath Simonette River and below the steep slope on the southeastern side of the river, the soils are anticipated to consist of silty clay, sandy silty clay, sandy silty gravel, and sandy gravel. The thickness of the soil layers ranged from 4 to 13m (13 to 43ft), and were described as firm and stiff to compact. Beneath the soil layers, the bedrock that was encountered and mainly comprised of siltstone and mudstone, with some layers of sandstone at depth. Numerous thick layers of coal (above 1m (3ft) thick) as well as loss of circulation was observed in the borehole at the top of the slope. The coal layers were located within the first 25m (82ft) of the bore from ground surface. The average RQD in the borehole on the northwest side of the river was 74, while the average RQD in the borehole on the slope closest to the river was 62, and the RQD average on the top of the slope was 85. Overall, the bedrock was described as highly weathered to moderately weathered and extremely weak to medium strong. The unconfined compressive strength ranged from 2.3 to 42.2 MPa (0.3 to 6.1ksi) for the bedrock layers. The landslide hazard assessment also designated the steep slope as a high potential hazard with the remainder of the slope leading up to the exit area as a low potential hazard.

Additionally, geophysics was completed 7m (23ft) off alignment to help delineate the soil to bedrock interface. The interface can be seen in Figure 3 where soil is depicted as yellow and bedrock as gray.

4.0 HDD GEOMETRY AND DESIGN

The HDD alignment was selected to be located with the bedrock materials, beneath the high potential landslide hazard zone, and below the thick coal seams layer at elevation 934 meters above sea level (masl). Due to the length of the HDD and deep-seated gravel layer above bedrock at the top of the slope, a drill and intersect methodology was selected for construction. The resulting HDD geometry consisted of a 14-degree entry angle, a 12-degree exit angle, and vertical curves with radii of 1400m (4593ft). The entry tangent was set to 53.5m (175.5ft) which allows for a 32m (105ft) entry conductor casing to be embedded into bedrock. The exit tangent was set to 474m (1555ft) to allow the HDD bore to have sufficient depth below the river as well as avoid the potential landslide hazards. This also ensured that the 74m (243ft) of conductor casing would be embedded within bedrock to stabilize the gravel layers on the upper slope. In addition, a large tangent on the exit would provide a longer intersect zone. A small horizontal tangent of 28.6m (93.8ft) was selected to separate the vertical curves and allow for additional steering prior to commencing the upward vertical curve. A 200m (656ft) intersect zone was selected to be located in the exit tangent above the vertical curve to allow flexibility to the HDD Construction Contractor in achieving the intersect. The resultant drill path is 1,191m (3907ft) long, with an approximate depth of cover of 50.8m (166.6) beneath the centerline of the Simonette river. The resulting bore geometry can be seen in Figure 3.

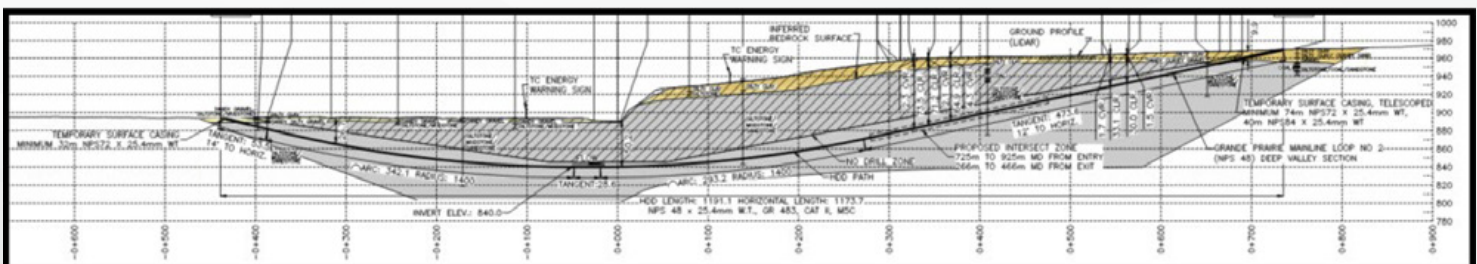


Figure 3 - HDD Bore Alignment

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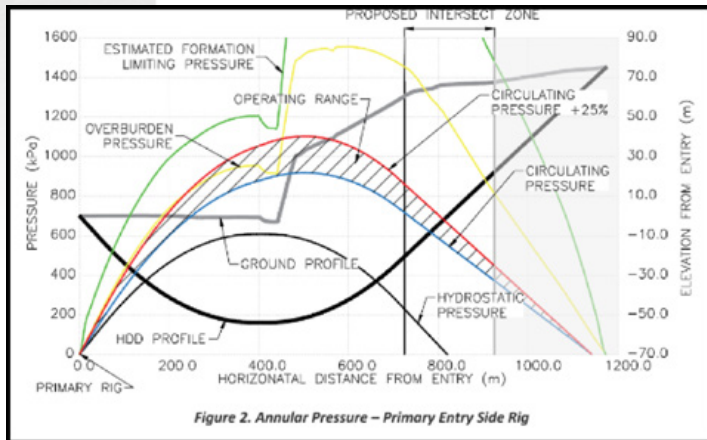


Figure 2 – Annular Pressure – Primary Entry Side Rig

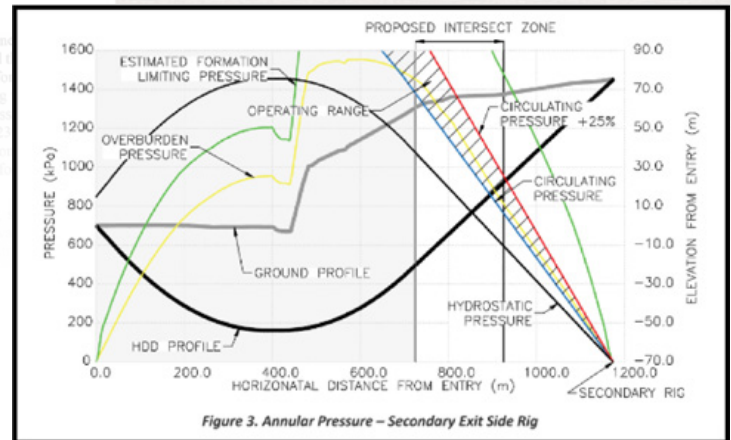


Figure 3 – Annular Pressure – Secondary Exit Side Rig

4.1 Hydraulic Fracture

The hydraulic fracture assessment for this crossing was performed using the Delft Geotechnics Method outlined in Appendix B of the Army Corps of Engineers 1998 Report CPAR-GL-98 and 2002 Report ERDC/GSL TR-02-9 (Guidelines for Installation of Utilities Beneath Corp of Engineers Levees Using Horizontal Directional Drilling) and TC Energy internal standards. This method estimates the maximum effective drilling fluid pressure that can occur within a given soil horizon during HDD operations. The calculated pressure is then compared to the pressure required to initiate slurry flow in the bore, determining the likelihood of hydraulic fracture for the proposed alignment. The Delft equation was developed for soil conditions and may have less applicability within a bedrock formation. In bedrock, fluid releases events typically occur through pre-existing voids and fractures. However, the equation can still provide a relative risk assessment indicating areas where fluid release is more or less likely. Figure 4 and Figure 5 provides the hydraulic fracture results for the pilot bore phase of the proposed crossing. Figure 4 shows pilot bore operations commencing from the rig positioned at the HDD entry location on the northwest side. Figure 5 shows the pilot bore operations from the rig

positioned at the HDD exit location on the southeast side.

A factor of safety of 2 was applied to account for design assumptions and variability in the geotechnical conditions, resulting in the estimated formation limiting pressure. The graphs also illustrate the total soil overburden stress, representing the equivalent unit weight of the assumed overlying soil (soils located within fractures and voids located bedrock) without considering soil strength. As shown in

the graphs, the required bore pressure to induce fluid flow (including an additional 25percent of pressure to allow for variability in HDD equipment and geotechnical conditions) is below the estimated formation pressure. This is partly due to the lower elevation of the entry side allowing the bore to be self-draining as seen in Figure 4. As well as the pilot bore being terminated with the proposed intersect zone when drilling from the exit rig location as seen in Figure 5.



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5.0 CONSTRUCTION SUMMARY AND CHALLENGES

Due to significant challenges including large elevation differences, pipe diameter, crossing length, and complex geotechnical conditions such as coal seams, zones of circulation loss, potential water ingress from the upper slope, and sections of the bore that could lack drilling fluid support, the HDD was classified as very high risk. While numerous mitigations were implemented where possible, the overall risk level remained high.

To manage these challenges, construction of the Simonette River crossing was scheduled over two separate seasons. SMJV served as the Prime Contractor for the project. The Crossing Company was selected as the HDD contractor, while The Tunneling Company was responsible for installing the entry and exit casings. CCI was designated as the onsite inspection team to ensure compliance and quality throughout the process.

Season 1 involved installing the entry and exit casings, beginning in Fall 2022 and concluding before spring breakup in March 2023. Season 2 focused on HDD drilling and pullback activities, planned to start in June 2023 and finish by December 2023.

5.1 Casing Installation

Casing installation commenced on November 22, 2022 and was completed on January 19, 2023. At the entry location, 42 meters (138ft) of casing was installed as opposed to the designed depth of 32m (105ft), while the exit location utilized a telescoping casing method, consisting of 72m (236ft) of NPS 72 casing installed within 41m (135ft) of NPS 84 casing. Due to significant elevation changes between the entry and exit points and the potential for water ingress from the slope, as well as fluid to surface at the leading edge of the casing, and undermining of soil at the casing to ground interface, the project team, in collaboration with all contractors, determined that embedding the casing a minimum of 10m (33ft) into bedrock was necessary. Standard casing installation procedures were insufficient for this requirement; therefore, once refusal limits were reached at the bedrock interface, a forward boring unit as shown in Figure 6 was deployed to break through the bedrock and achieve the desired depth. Similarly, at the exit location, reaching the target depth was critical due to a thick gravel layer above bedrock.

Although a telescoping method was planned and implemented, hard ground conditions, including large cobbles, caused refusal limits to be reached and

difficulty augering the large cobbles out of the casing. To overcome this, a Small Boring Unit (SBU) as shown in Figure 7 was ultimately utilized to break up the larger cobbles within the casing and penetrate the harder formation to complete the casing installation. Small Boring Units (SBU) are not commonly used in high angle casing installations due to the inability to move cuttings from the cutting face beyond the main bearing to the augers. To mitigate this issue, TTC modified the assembly to encourage the auger to pick up and convey cuttings up the casing pipe. In addition to this, TTC utilized the hollow stem augers to distribute a bentonite slurry to the face of the cutting wheel that would prevent the face of the wheel from becoming plugged if clay/silt ground conditions were encountered.

5.2 Water Infiltration Plan

The Engineering Service Provider responsible for inspection developed a comprehensive water mitigation plan to address potential groundwater ingress into the HDD borehole. This plan outlined strategies to manage hydrogeological risks and ensure operational continuity throughout the drilling process.

To mitigate the potential for water ingress from the upper slope, the project team elected to utilize a rotating head at the entry point. This equipment was specifically chosen for its capability to



Figure 6 – Forward boring Unit



Figure 7 – SBU

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Figure 8 – NPS 72 Rotating Head



Figure 9 – Additional containment for Drilling Fluid

slow down fluid flushes during drilling operations, thereby reducing the risk of uncontrolled fluid movement. Despite this precaution, concerns persisted regarding the mud plant's capacity to process the full volume of drilling fluid should significant flushes occur during the bore. To further manage this risk, given

the availability of space at the entry location, supplementary containment infrastructure was constructed, including a C-Ring with a capacity of 3,300m³(116,538ft³), to provide an extra layer of containment in the event it was required. TCC also designed and built a specialized L-tank system that was buried

into the ground to be used as an entry sump. The design allowed for significantly more fluid capacity than a typical ground sump. The extra capacity was utilized in the event of any hole flushes/surges and addressed the concerns with ground water ingress.

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As part of the site preparation strategy, a berm and ditch system was constructed around the entry pad to control and direct fluids in the event that groundwater flow from the HDD bore exceeded other planned mitigations. Furthermore, the access road leading to the entry pad was designed to accommodate heavy traffic under soft ground conditions, ensuring reliable equipment movement throughout the project.

5.3 Entry Pad Flooding

During the exceptionally wet spring season, the entry pad experienced significant flooding in June 2023, which required extensive dewatering efforts to restore site functionality. Following water removal, rig mats were repositioned to ensure stability, and repairs were carried out on sheet piling and conductor casing that had been impacted by the flooding.



Figure 10 - Entry Pad Flooding

In addition to these corrective measures, environmental compliance activities were undertaken, including amphibian and fish salvage operations to mitigate ecological impacts. These unforeseen conditions and remediation efforts resulted in a three-week delay to the commencement of HDD operations.

5.4 Pilot Hole/Reaming 36-Inch and 42-Inch

Pilot Hole Operations

Prior to initiating pilot hole operations, a 16-inch centralizer was installed within the casing to ensure proper alignment as the pilot hole exited the NPS 72 casing.

During installation, the HDD contractor encountered difficulty advancing the centralizer to the leading edge of the casing. To resolve this, the centralizer was temporarily removed, and a reamer was utilized to clear debris from the casing. Once the casing was cleaned, the centralizer was successfully installed to the required depth.

Pilot hole drilling progressed smoothly on the entry side; however, achieving the desired build rate beyond the bore bottom presented challenges. Adjustments were made to the mud motor bend angle, increasing the sub angle to improve steering performance. On the exit side, operations were impacted by fluid losses and reduced circulation, averaging approximately 70%. Lost circulation material was deployed, which partially restored flow, and despite these losses, no inadvertent returns to the surface were observed. The intersect operation required three days to complete. A rotating head was installed prior to the intersect, and during the process, a fluid flush occurred. The rotating head effectively managed the excess drilling fluid.

30-Inch Reaming

The 30-inch reaming pass was executed without significant issues. Full drilling fluid circulation was maintained throughout the operation, and no groundwater ingress was detected. A TCI reamer was utilized for this stage, which was completed in approximately 15 days.

42-Inch Reaming

The 42-inch reaming operation also proceeded without major complications. Full circulation was observed, although minor water ingress was noted at the mud plant. This phase employed a TCI reamer and required approximately 21 days to complete.

5.5 Drill Pipe Break 1

Following the completion of the 42-inch ream, the HDD contractor initiated the 54-inch reaming phase. During tripping-

out activities, significant volume of cuttings were observed, necessitating the use of vacuum trucks to manage removal. The high generation of cuttings during this pass prompted TCC to implement a parasite string to increase fluid flow and improve cuttings transport from the bore back to the entry rig.

On October 4, during the 54-inch reaming pass, a drill pipe failure occurred at a measured depth of 910m(2986ft) from the entry rig side (Figure 11) within a section of the bore that was not supported by drilling fluid. The break was located 0.59m(1.9ft) into joint one, which was directly connected to the reamer.



Figure 11 - Drill Pipe String break #1

The location of the drill pipe break can be seen in Figure 12. Three initial fishing attempts were attempted but were unsuccessful. To better assess the situation, the contractor deployed a video feed to determine the orientation of the broken pipe attached to the reamer. Given that the failure point was above the entry rig elevation, it was anticipated that the section of the bore lacked fluid, making video inspection feasible.

The fourth fishing attempt, conducted on October 11, successfully latched onto the broken string. However, while tripping out the fishing assembly with the reamer attached, the assembly became lodged within the bore. A secondary string was deployed to clean and remove accumulated cuttings behind the assembly, enabling progress. Ultimately, the 54-inch reamer was successfully

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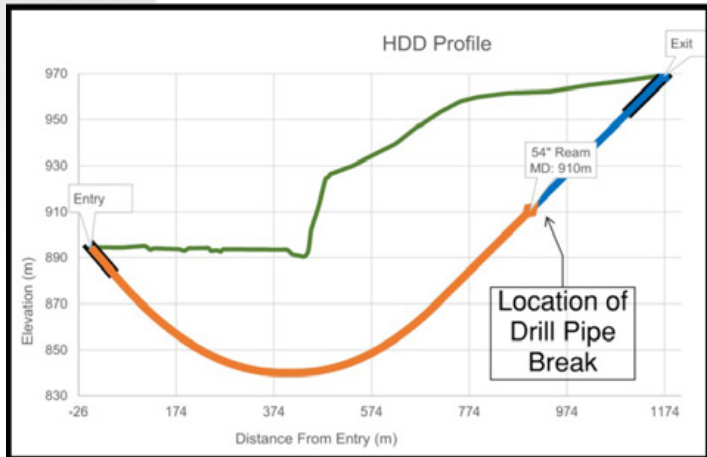


Figure 12 – Drill Pipe break #1



Figure 13 – Drill Pipe break #1

tripped out of the hole on October 14 (Figure 13) after 9 days of fishing operations.

5.6 Drill Pipe Break 2

Following the successful fishing operation to recover the 54-inch reamer, the 54-inch reaming pass resumed. Progress was

limited, however, as the reamer was only able to advance to approximately 942m (3091ft) measured depth before encountering resistance. The reamer was subsequently tripped out, and significant wear was observed on the tooling, indicating challenging ground conditions within that interval.

At the 942m (3091ft) measured depth, the borehole was suspected to have experienced a collapse. In response, the contractor elected to continue reaming operations from the exit side to reopen the obstructed section. A 42-inch reaming pass was first completed to stabilize and enlarge the caved-in zone,

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after which the 54-inch reamer was run from the exit side. This approach successfully advanced the reamer past the 942m (3091ft) location. The reamer was then tripped back downhole to the entry rig, marking the completion of the 54-inch reaming stage. This phase required 34 days, accounting for the operational challenges encountered.

Upon completion of the 54-inch pass, the 60-inch reaming stage commenced. Similar to the previous stage, the 60-inch reamer was only able to progress to approximately 855m (2805ft) measured depth before high torque readings were observed. The contractor decided to trip out the reamer and reposition it at the exit rig to continue reaming from the high side toward the obstruction.

Reaming from the exit side initially progressed with only minor flushing concerns. However, on November 16th, the drill pipe failed 0.9m (3ft) into joint 1 on the exit side, directly behind the reamer. This break occurred at an approximate depth of 930m (3051ft) measured depth (relative to the entry point). This left only 75m (246ft) of 54-inch borehole remaining to be reamed to 60-inch. Once again, the drill pipe break occurred in the portion of the bore not supported by drilling fluid.

Multiple fishing attempts were carried out from the exit side to recover the drill pipe and reamer, but these efforts were ultimately unsuccessful due to compromised borehole integrity between the exit rig and the positioned

60-inch reamer. Attempts included cleaning the drill path, trialing various fishing assembly configurations, and deploying a downhole video system. The video inspection did not yield usable imagery, as the section of bore remained fluid-filled and visibility was insufficient. After 25 days on Dec 10th, with no viable recovery path, the decision was made to proceed with a partial re-drill.

A mechanical disconnect was required to detach the drill pipe still connected to the reamer on the entry side. The charge was set at a measured depth of 910m (2986ft), and once activated, the disconnect successfully separated the string, leaving three pipe joints attached to the reamer within the borehole.

5.7 Partial Redesign

During the fishing operations, the engineers of record were tasked with preparing a partial redesign of the drill alignment in the event recovery efforts failed. The revised design sought to maximize reuse of the existing borehole while maintaining constructability and structural feasibility. The updated alignment shifted the exit point laterally by 5m (16ft) and extended it 10m (33ft) beyond the original location. The design incorporated reuse of approximately 457m (1499ft) of the initial bore from the entry rig to the lower belly of the profile, after which new vertical and horizontal curves were introduced to diverge from the existing bore and intersect the newly defined exit target.

Casing Installation

To accelerate the partial re-drill schedule, the project team mobilized new NPS 72 and NPS 84 casing rather than extracting and re-using the casing from the original drill attempt. This approach minimized downtime and eliminated the risks associated with handling and repositioning previously installed casing.

Casing installation progressed smoothly. The 84-inch casing was installed over a six-day period, followed by the installation of the 72-inch casing, which required an additional ten days. Both installations were completed without notable delays or mechanical issues.

Pilot Hole Operations

Pilot hole operations for the partial re-drill commenced on January 1, 2024. For this attempt, the HDD contractor selected an at-bit-inclination assembly to provide at-bit steering accuracy and enhance the ability to maintain the redesigned alignment.

During the pilot hole operations, the project experienced issues similar to those encountered during the original bore, including drilling fluid losses along the upper slope and required re-work of drill string joints to ensure compliance with the pilot hole specifications. The application of a bentonite-chip-based lost-circulation material (LCM) proved effective in re-establishing and sustaining acceptable circulation throughout this section.

Pilot hole operations were successfully completed on January 12, 2024, marking the conclusion of the initial stage of the partial re-drill.

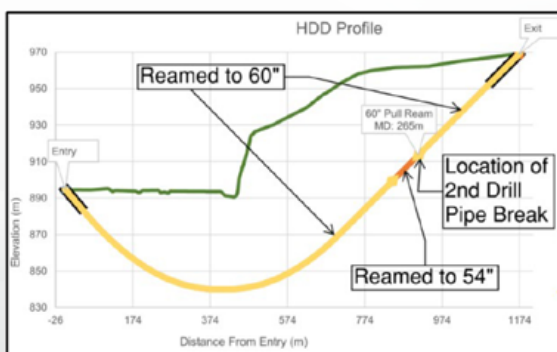


Figure 14 - Location of 2nd Drill Pipe Break

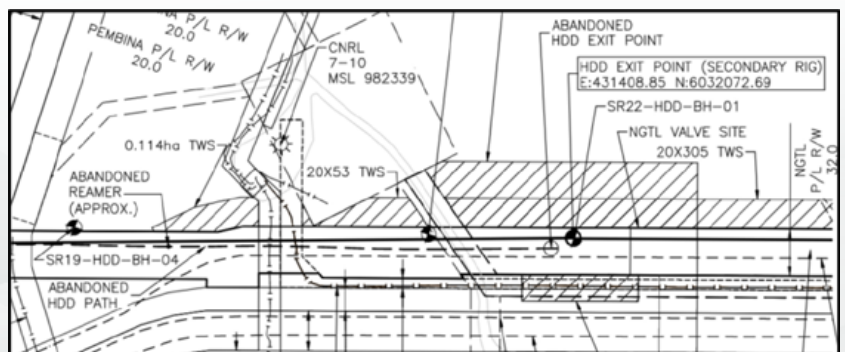


Figure 15 - Plan View of New HDD Exit Offset

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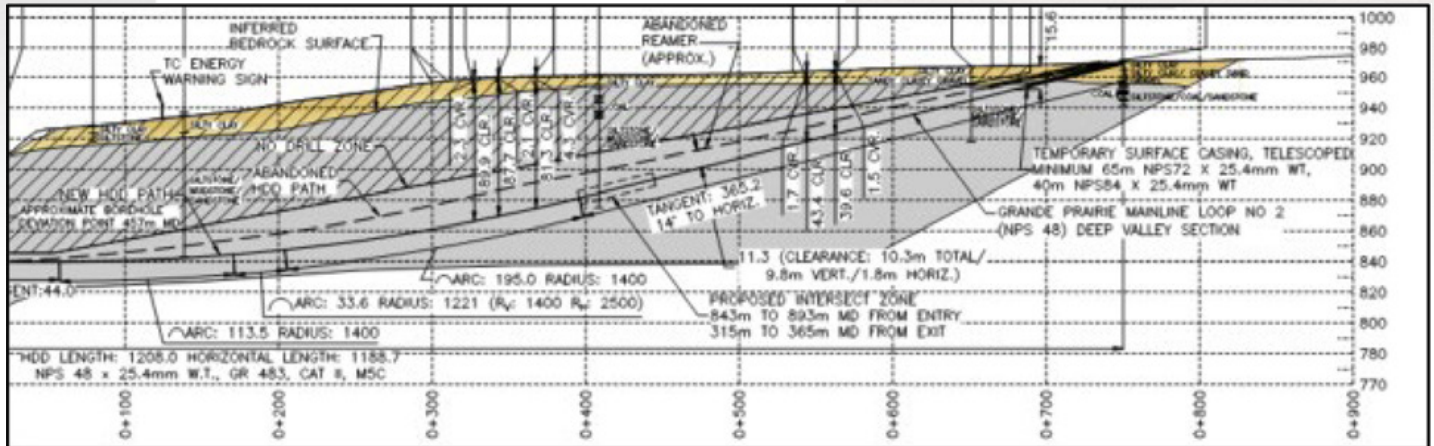


Figure 16 – Profile View of Partial Redesign

30-Inch Ream

For the 30-inch reaming pass, the HDD Contractor implemented a revised strategy to improve operational efficiency and manage downhole conditions. Reaming was initiated from the entry side and advanced to approximately 900m (2953ft) measured depth. The 900m (2953ft) measured

depth was selected because it was at the same elevation as the entry rig and therefore the furthest point in the drill that would have drilling fluid in the borehole. The 30-inch reamer was then relocated to the exit side, where reaming proceeded back down to the same depth interval before the reamer was tripped out to the exit rig. A weeper

sub was utilized to enhance drilling fluid circulation throughout the process. Minor fluid flushes were observed in sections of the bore situated above the entry rig elevation; however, these events were effectively controlled using the rotating head and specialized L-tank sump on entry. The 30-inch reaming pass was completed in a total duration of 15 days.



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42-Inch Ream

A similar strategy was employed for the 42-inch reaming operation as was used for the 30-inch ream. The approach involved drilling a portion of the hole from the entry side to the same predetermined stoppage point, after which the reaming activities were initiated from the exit side back toward that same location. This methodology allowed for improved control of tool alignment, optimized cuttings transport, and better management of downhole conditions within the anticipated challenging sections of the alignment.

In addition, the project team implemented a 30-inch stabilizer positioned directly behind the 42-inch reamer to further reduce bending moments experienced within the wobble joint. This configuration was selected to improve tool string stability, maintain a more consistent bore trajectory, and decrease stress concentrations on the drill string components during the high-load sections of the reaming pass.

Operational parameters remained within expected ranges for the majority of the 42-inch reaming phase. However, elevated torque values were observed in specific intervals, largely attributable to the additional mass of the heavy-wall drill pipe as well as the presence of the 30-inch stabilizer. The reaming pass also encountered periods of heavy cuttings accumulation and intermittent fluid flushes, both of which were anticipated based on the ground conditions and the tooling configuration.

The complete 42-inch reaming pass was executed over a duration of 16 days.

5.8 Drill Pipe And Inspection Plan Change

The original drill pipe used for the Simonette crossing consisted of standard-wall API double-white-band pipe, Grade S-135, with a 6 5/8-inch outer diameter. Prior to being placed into service, the drill pipe underwent an initial inspection before arriving on site,

followed by additional inspections prior to each reaming pass 42-inches and larger, as well as before pullback operations. These inspections were focused solely on the power side of the drill string, as torque for the Simonette drill was provided by the entry-side rig located at the lower elevation.

Wobble joints were routinely removed from the drill string and replaced with freshly inspected pipe at the completion of each reaming pass and after any planned tripping activities associated with reaming passes of 30-inches or greater. This practice ensured that higher-wear components were regularly taken out of circulation and assessed before further use. The baseline inspection program followed the standard level of inspection outlined in API RP 7G-2, which included a full-length visual inspection, a full-length electromagnetic inspection (EMI), and a detailed examination of box and pin connections.

After experiencing two drill pipe failures earlier in the project, additional inspection requirements were implemented to proactively identify and remove marginal joints. To reduce the likelihood of further drill pipe breaks, the project team adopted a modified moderate inspection level

from API RP 7G-2. This enhanced program incorporated magnetic particle inspection (MPI) and ultrasonic testing (UT) of 42-inches on either side of each joint. These methods were selected to more effectively detect both surface and subsurface flaws that could propagate into full-body failures under drilling loads.

The upgraded inspection scope was initiated during the partial re-drill. Over the course of this effort, a total of 2,344 drill pipe joints were inspected, and 657 joints were rejected. Of those removed from service, 61 were rejected due to MPI findings, 20 due to EMI indications, 54 due to UT results, and 514 for threading and resurfacing based on visual inspection observations. The adoption of the modified moderate inspection level significantly improved the project team's ability to identify and eliminate pitted, cracked, or otherwise compromised drill pipe, thereby reducing the risk of future drill pipe failures and increasing overall operational reliability. Figure 17 shows drill pipe rejection by method.

Additionally, given the history of drill pipe failures on the project, the team elected to utilize heavy-wall drill pipe in place of standard drill pipe within the wobble joint for the remainder of the reaming phases. The wobble

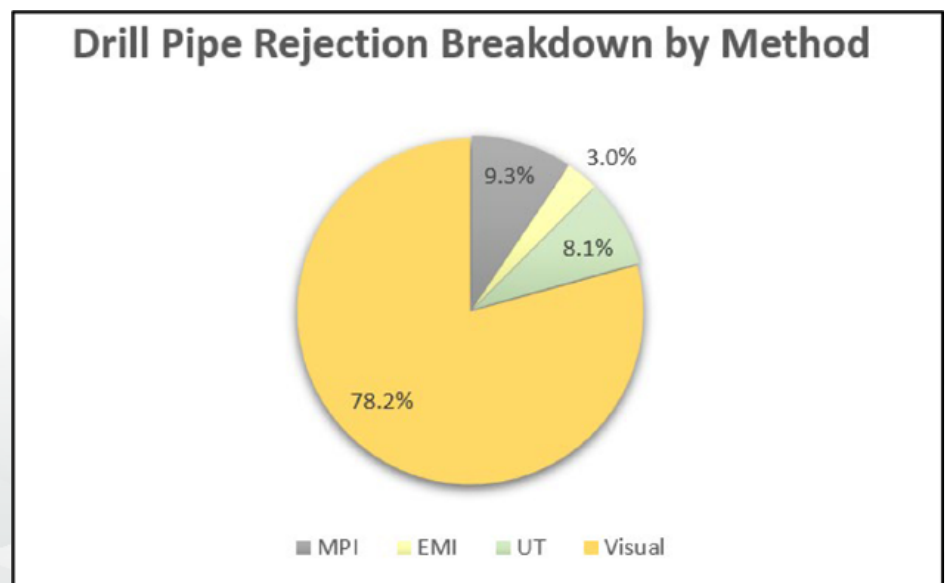


Figure 17 – Drill Pipe Rejection by Method

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joint assembly consisting of three drill pipes positioned on either side of the reaming assembly was identified as a critical location where higher bending and torsional loads were likely to occur. The use of heavy-wall pipe provided increased structural robustness and reduced the likelihood of fatigue-related issues during the reaming process.

5.9 54-Inch Ream/60-Inch Ream Drill Pipe Break 3 And 4

Following completion of the 42-inch reaming pass, the contractor transitioned into the 54-inch reaming phase. For this stage, the contractor again utilized the heavy-wall drill pipe in the wobble joint configuration and deployed a 36-inch stabilizer positioned directly behind the 54-inch reamer. A reaming strategy similar to that employed during the 30-inch and 42-inch passes was planned, including a designated stoppage point at approximately 910m (2986ft) measured depth (MD). However, the contractor

elected to adjust the exact stoppage locations slightly in order to minimize the risk of forming a ledge within the borehole.

During the 54-inch reaming operations, elevated torque levels were observed, along with significant volumes of cuttings returning to the entry side. At approximately 913m (2995ft) measured depth slightly beyond the contractor's intended trip-out point a drill pipe failure occurred. The break was located between the stabilizer and the reamer, approximately 0.56m (1.8ft) from the reamer body. It should be noted that this drill pipe failure occurred at approximately the same elevation as the previously identified "trouble zone" where the two prior drill pipe failures occurred. The contractor once again relied on downhole video inspection to determine the appropriate configuration for the fishing assembly. The fishing assembly successfully latched onto the parted pipe on the first attempt;

however, during extraction of both the fishing assembly and the 54-inch reamer, the latch separated multiple times. Despite these interruptions, the contractor was able to re-engage the assembly each time, ultimately recovering the 54-inch reamer from the bore on March 1, 2024.

Based on the recurring issues encountered near the 910m (2986ft) measured depth zone, the project team elected to reopen the borehole from the entry rig up to just short of the problematic interval encountered during the previous reaming attempt. This approach allowed the team to re-establish bore integrity prior to advancing further toward the identified risk area.

The contractor proceeded with the 60-inch reaming phase by installing the 60-inch reamer and positioning a 36-inch stabilizer directly behind it. As with previous passes, the heavy-wall drill pipe was again utilized within the



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wobble joint assembly. During one of the scheduled trips, the 60-inch reamer made contact with the casing lip, likely caused by a washout at the leading edge of the casing. Pull forces increased to approximately 370,000 lbs. While the 16-inch centralizer successfully centered the 36-inch stabilizer, the washout allowed the larger reamer to sag beyond the centralizer's effective centralization.

Due to the stabilizer it was impossible to utilize centralizer to pick the 60" reamer up into the casing. The project team determined that the safest approach was to perform a mechanical back-off to separate the stabilizer from the reamer, followed by fishing operations to retrieve the reamer. The initial back-off attempt, however, resulted in unintended separation of the stabilizer from the drill string, requiring it to be fished out first. After successfully retrieving the stabilizer, the mechanical back-off was attempted again and successfully separated the 60in reamer from the 36-inch stabilizer. Fishing operations then proceeded for the 60-inch reamer, with the 16-inch centralizer assisting in guiding and centering the reamer as it approached the casing. Once the reamer reached surface, the 60-inch reaming pass was able to continue.

A few days later, another drill pipe failure occurred while the 60-inch reamer was positioned at approximately 420m (1378ft) measured depth. The break occurred 0.45m (1.4ft) from the joint connected to the reamer on the entry side. Fishing operations were deployed once more, and after several attempts the reamer was successfully recovered. Upon inspection at surface, the threads on the reamer showed evidence of damage from the fishing operations, and the contractor replaced it with a newly inspected 60-inch reamer before resuming operations.

Reaming progressed to approximately 850m (2789ft) measured depth just below the previously identified problematic zone on the upper slope at which point the reamer was tripped back to the

entry side. Throughout the 60-inch reaming process, multiple instances of elevated torque and substantial volumes of cuttings returning to surface were observed. After the reamer was retrieved at entry, the project team elected to enlarge the bore from the exit side, using the 54-inch reamer to advance past the problematic zone. During this phase, increased water ingress was encountered; however, the rotating head and fluid management system effectively handled the additional flow and drilling fluid flushes.

The intention was to open the bore through the problematic zone to intersect with the already-established 60-inch section, then utilize the 60-inch reamer from the exit side in a similar manner. However, during the 54-inch reaming pass, the contractor elected to trip the reamer out at the exit to allow the forward-reaming Durango unit to stabilize the problematic interval. During extraction, the reamer became key-seated within the formation. To avoid the risk of another drill pipe failure, the decision was made to continue pushing forward toward the entry side rather than attempting to pull the reamer back to exit. The 54-inch reamer successfully intersected both the 54-inch and 60-inch bore segments and was ultimately

extracted at the entry location.

Given the persistent challenges within the problematic upper-slope zone, the project team concluded that maintaining the upper portion of the bore at a 54-inch diameter offered the greatest likelihood of a successful installation. Although unconventional for an NPS 48 installation which typically requires a full 60-inch bore the modified approach would see the NPS 48 pipe being pulled through 358m (1175ft) of 54-inch bore than 850m of 60-inch bore. Figure 18 shows the bore with both the sections opened up to 54-inch (in orange) and 60-inch (in yellow).

5.10 Pull Back With Thruster

Prior to commencing pull-in operations, the contractor completed a wiper and cleaning pass using a 48-inch reamer from the exit side to the entry side. During this pass, four sections within the 54-inch bore exhibited higher-than-anticipated rotary torque, indicating localized tight zones or areas of instability within the annulus.

Given the ongoing challenges encountered throughout the HDD execution, combined with the decision to leave a portion of the bore at 54 inches rather than fully enlarging it to

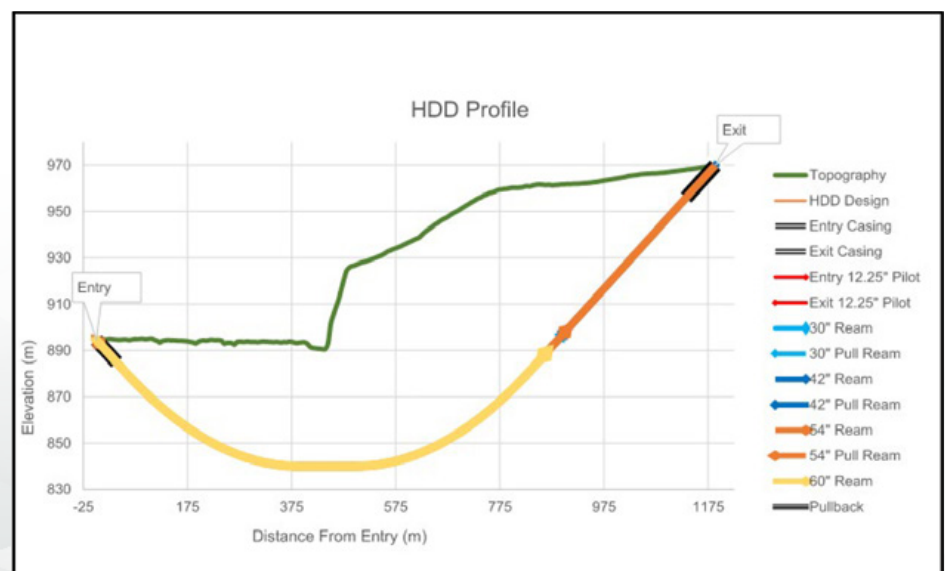


Figure 18 – Diameters of bore prior to Pullback

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Figure 19 – Thruster used during Pullback



Figure 20 – Product Pipe Installation Successful

60-inches, the project team elected to mobilize a Direct Pipe® thrusting unit to support the pull-in activities (Figure 19). The HDD contractor coordinated and provided the thruster used for pullback operations. Following completion of the wiper pass, approximately four days were

required to prepare the site and install the thrusting system.

The initial pull-in attempt began on April 17, 2024. However, only 90m (295ft) of product pipe was installed before pull loads escalated to approximately

500,000lbs, even with the thruster assisting. At this point, the project opted to withdraw the pipe and reconfigure the pull-head assembly. The contractor removed the knuckle from the pull-head, as the articulated joint allowed too much freedom of movement and prevented

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the product pipe from maintaining proper alignment behind the reamer.

A second pull-in attempt commenced on April 17. Progress remained slow, requiring the use of the thruster and hammer, particularly within the tighter sections, where the borehole was only reamed to of the 54-inches. It is important to note that the thruster and hammer were never used at the same time as the hammer could compromise the clamping unit on the thruster. When pulling while using only the hammer and rig, the product pipe experienced intermittent forward lunging, which raised safety concerns due to the breakover setup and the associated risk of drill pipe failure. Operations at site were adjusted to address the safety concerns by utilizing the thruster more consistently to ensure a more controlled and steady advancement of the pipe.

Buoyancy control was applied throughout the pull-in process and maintained at approximately 30% of the planned level. For the remainder of the installation, pulling pressures remained stable, with peak loads recorded at 660,000lbs on the drill rig and 623,000lbs on the thruster. The average pull force without the use of the thruster was 520,000lbs and the average thrust was 220,000lbs. The product pipe was successfully installed on April 23, 2024 (Figure 20).

6.0 CONCLUSIONS

The successful installation of the Simonette River HDD on April 22, 2024 marked the completion of a technically complex and high-risk crossing. Despite the need for a re-drill on the upper slope following the unsuccessful first attempt and the inability to extract the 60-inch reamer the project team

was able to advance the installation to completion, though the crossing ultimately exceeded the planned schedule by 76 days. From the outset, the risk profile for this HDD was recognized as extremely challenging, and although comprehensive mitigation strategies were implemented, the combination of geotechnical uncertainty, loss of circulation, elevation differential, and larger bore diameter requirements contributed to the persistence of a high-risk environment throughout construction.

The 74m elevation change between entry and exit created unique construction challenges once reaming exceeded 42-inches in diameter. While early phases of the work encountered only minor issues, the upper slope proved particularly problematic during the larger reaming passes (54-inch and 60-inch) due to the formation characteristics, including coal seams, fluid-loss zones, and heterogeneous sedimentary bedrock units. Future HDD designs in similar geological and elevation conditions should avoid installing product pipe larger than NPS 36 where possible, as larger bore diameters with large elevation changes significantly heighten construction risk.

Several mitigation measures proved effective during execution. The water-ingress management strategy which included onsite availability of a rotating head and enhanced drilling-fluid containment infrastructure provided important safeguards, even though the rotating head was not required for the full duration of operations. Additionally, the adoption of a modified moderate drill-pipe inspection protocol, incorporating MPI and UT of the critical ends of each joint, improved the project team's ability to identify and remove compromised pipe.

Although drill-pipe failures still occurred, the enhanced inspection reduced the likelihood of additional incidents by eliminating joints with emerging integrity concerns.

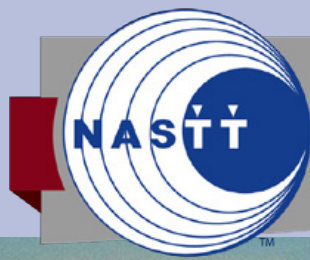
Adaptation to the typical bore design of 60-inch diameter also played a key role in achieving a successful installation. Maintaining the upper portion of the bore at a final 54-inch diameter, though unconventional for an NPS 48 installation, proved to be an essential decision. This reduced diameter approach minimized additional reaming requirements within the problematic upper slope, limiting exposure to zones that had already demonstrated instability and excessive risk.

Finally, the decision to incorporate a Direct Pipe Thruster was critical. It prevented uncontrolled pipe movement that could have jeopardized crane stability and overall site safety. The thruster also provided the necessary guidance and thrust to maneuver the product pipe through the tighter 54-inch section, where the drill rig alone would likely have been insufficient.

Overall, the combination of enhanced inspection, adaptive construction methodology, effective risk mitigation, and strategic equipment use enabled the project team to complete a highly complex and demanding HDD installation under difficult conditions.

7.0 REFERENCES

API, Inspection and Classification of Used Drill Stem Elements API RP 7G-2, Second Edition, October 2020, Annex B
Pipeline Research Council International, Installation of Pipelines by Horizontal Directional Drilling: An Engineering Design Guide, Catalog Number PR-227-144507-R01, 2015



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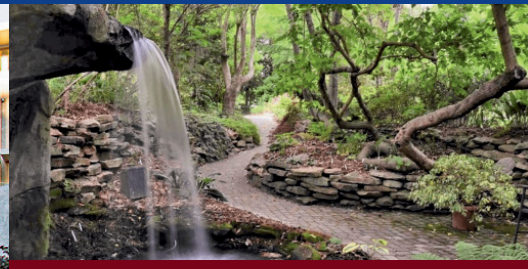
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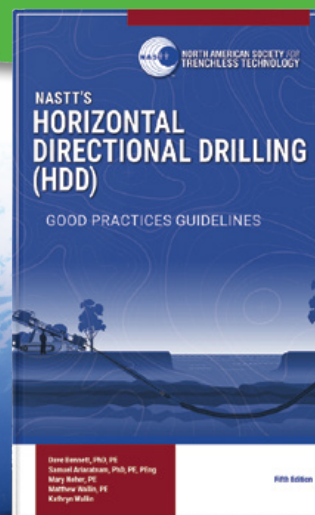
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