MIDWEST JOURNAL OF

TRENCHLESS TECHNOLOGY 2021

OFFICIAL PUBLICATION OF THE MIDWEST SOCIETY FOR TRENCHLESS TECHNOLOGY

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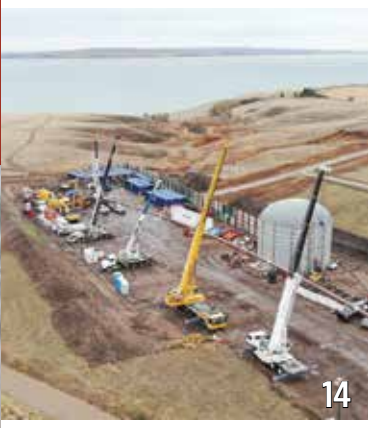

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MESSAGE FROM THE PRESIDENT

Chris Schuler, MSTT President

Thanks to everyone for your support over the years. We are now celebrating the ninth annual publication of ***Midwest Journal of Trenchless Technology***. We could not do it without the continued support of the many companies and individuals that comprise the MSTT community.

About MSTT: Established in 1998, MSTT is one of the oldest and the largest of the twelve NASTT Regional Chapters. MSTT encompasses the nine states of Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, Ohio, and Wisconsin.

2021 Seminars: MSTT conducted one live, in person seminar on August 25, 2021. It featured a presentation by Mr. Kevin Lyons, P.E., Engineering Design Manager, Milwaukee Metropolitan Sewerage District; Milwaukee WI titled "Trenchless Technology at Milwaukee Metropolitan Sewerage District", as well as ten other presentation covering a wide array of topics by industry professionals. The event was well attended with great conversation about trenchless solutions (see page 44). Another event was planned in Cincinnati in October, but was postponed because of local COVID concerns. We are early in the planning phase for the 2022 seminars.

2022 No-Dig Show: While the 2021 No-Dig Show was well attended both virtually and in person, we look forward to having an event in person and getting all of the intelligent and talented members of our trenchless industry back together displaying new and old technologies, continuing the long-standing educational and networking event. The 2022 No-Dig Show in Minneapolis should fit that bill nicely.

MSTT:

Advancing the science and practice of Trenchless Technology for the public benefit, to promote and conduct education, training, study and research in said science and practice for the public benefit.

It is no secret that our lives changed since 2020. Many of us have learned ways to get our jobs done from home and lead others from the remote workspaces we have mastered. Still, not all of the work that needs done on our infrastructure can be done remotely. I am honored to work in an industry that offers indispensable, essential services in an effort to improve the places we live.

Overcoming challenges is, however, what this industry is all about. We have for many years encountered what couldn't be done and found a way to do it. We have run into tasks that were marginally successful, or not at all, and found methods to make them better and very successful. The Trenchless Industry will continue to grow to meet the challenges that we will encounter. We will continue to find better ways and better methods to meet the demands of our aging infrastructure.

I was re-elected Chair of the MSTT in April 2021. I am thankful for the opportunity to serve and look forward to the bright future of MSTT and NASTT.

MSTT is your organization, and this is your publication, so please support us and let us hear what you think. To provide feedback, suggest a location for future events, place an ad, or submit an article for next year's journal; please contact Leonard, me, or one of our directors. Your support and involvement is critical to our success and the success of the Industry as newer faces enter and greater challenges present themselves.

Sincerely,

MSTT SITE

Chris Schuler
President, MSTT
317-653-5203
chris.schuler@millerpipeline.com

GREETINGS FROM THE MSTT EXECUTIVE DIRECTOR

Leonard E. Ingram, Sr., PWAM, Executive Director, MSTT

Things are looking up! The Midwest Society for Trenchless Technology had a little better year in 2021 than 2020, but not much with Covid 19 still hanging around. At the end of 2020, we did have the successful "MSTT Trenchless Technology 2020 Fall Webinar" on Tuesday, December 17, 2020 from 11:00 am to 1:00 pm EST. The live Webinar was free and offered 2 PDHs. We had 171 attendees to pre-register and 144 to attend the entire two hour seminar. The Webinar was conducted through the NASTT Chapter Webinar Program with four presentations that were 30 minutes each. An excellent Q&A session was at the end of each presentation. **A Big Thanks goes out to Mrs. Jesse Clevenger and NASTT for a job well done!**

In 2021, MSTT had plans to conduct seminars in Milwaukee and Cincinnati. The Cincinnati seminar had to be postponed until 2022 because of an increase of Covid 19 in the area. A very successful "Trenchless Technology, SSES and Buried Asset Management" seminar was conducted in Milwaukee WI on July 27, 2017. The Guest Presenter was Mr. Kevin W. Lyons, P.E., Engineering Design Manager, Milwaukee Metropolitan Sewerage District, with the presentation, "Milwaukee Metropolitan Sewerage District – A Tunneling Overview".

The MASTT, MSTT & SESTT 2022 Proposed Seminar, Webinar and Journal Publication Schedule will be published and placed on the websites in January of 2022 once all the larger events and shows have established their 2022 dates. The 2022 Seminar Schedule will consist of seminars in Baltimore, Atlantic City and Cincinnati that were postponed in 2021 and other trenchless hot spot areas that we have not visited in the past three years. This schedule is updated regularly and includes planned webinars and annual Society journal's information.

Thanks for your support!

Your support and participation with MASTT, MSTT and SESTT Seminars, Webinars and Journals are very much appreciated, and **YOU** make **US** successful.

Thanks For Your Support!

Leonard E. Ingram, Sr., PWAM
Executive Director, MASTT, MSTT & SESTT

PLEASE REVIEW THE MASTT, MSTT AND SESTT 2022 PROPOSED SEMINAR AND JOURNAL PUBLICATION SCHEDULE:

SOCIETY	LOCATION/PUBLISH	PROPOSED DATE	STATUS
SESTT SEMINAR	NASHVILLE TN	MAR 16, 2022 - WED	PROPOSED
MSTT SEMINAR	CINCINNATI OH	MAY 11, 2022 - WED	PROPOSED
MASTT SEMINAR	BALTIMORE MD	JUL 20, 2022 - WED	PROPOSED
MASTT JOURNAL	PUBLISH DATE (DEADLINE (05/27.22)	JUNE 15, 2022	PROPOSED
MASTT SEMINAR	ATLANTIC CITY NJ	SEP 14, 2022 - WED	PROPOSED
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MSTT SEMINAR	ST. LOUIS MO	OCT 26, 2022 - WED	PROPOSED
SESTT SEMINAR	BATON ROUGE LA	DEC 7, 2022 - WED	PROPOSED
SESTT JOURNAL	PUBLISH DATE (DEADLINE (11/19/22)	DEC 9, 2022	PROPOSED

To Exhibit, Food Sponsor, or Present at the 2022 Seminars:

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MESSAGE FROM NASTT CHAIR

Alan Goodman, NASTT Chair

Our Chapter Members and Volunteers are Crucial to our Society

Hello Midwest Chapter Members! The trenchless industry grows stronger every year. Even in the pandemic our membership and regional chapters are moving forward to educate the public. It's amazing when you look back at what we have done in 2021. We had an in-person and virtual No-Dig Conference in Orlando this past March, leading the industry in safely meeting face to face once again. Many of our Regional Chapters held their fall conferences and networking events all over North America.

NASTT's mission and vision are "to continuously improve infrastructure management through trenchless technology" and "to be the premier resource for knowledge, education, and training in trenchless technology." With education as our goal and striving to provide valuable, accessible learning tools to our community, one of the things of which we are most proud at NASTT is that even during uncertainty we have been able to grow. Recently, we welcomed our latest Regional Chapter to the NASTT family and completed our representation of the entirety of North America. NASTT is so excited to announce that we now have our first chapter in Mexico!

We are a resilient industry!

Looking ahead, we are currently planning the NASTT 2022 No-Dig Show to be held in your Midwest backyard in Minneapolis, Minnesota, April 10-14 next spring. We are anticipating over 2,000 attendees and over 200 exhibitors. There are many new features we plan to roll out including enhanced educational forums, more networking opportunities and expanded exhibit hall time. Our industry is constantly growing in innovative ways and the No-Dig Show is a representative of our industry. We are excited to bring new value and educational experiences to you in April. Visit www.nodigshow.com for all the latest details and to register or exhibit today.

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

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

Alan Goodman

Alan Goodman
NASTT Chair

MSTT BOARD EXECUTIVE 2021-2022

Chris Schuler - *President*

Chris Schuler joined Miller Pipeline in 1984 as a laborer in Indianapolis, Indiana. Over the next few years he served the company in many capacities, assuming the role of equipment operator in 1989 and foreman the following year. In 1998 Chris stepped into the role of superintendent over Kansas City and Indianapolis until 2005 when he was promoted to project manager. In 2009 he assumed his current role as general manager of the Municipal Services Division where he oversees Miller Pipeline's water/wastewater trenchless rehabilitation operations.
Chris attended Indiana University from 1983-1986 focusing on Economics and Business. He graduated from the University of Missouri with a B.A. in Commercial Economics in 2001. Chris serves as the current Miller Pipeline Representative for the Indiana Chapter of NUCA. He is also a member of the NASTT Program Committee in addition to his role as President of the MSTT Board of Directors.

Ryan Poertner - *Vice President*

Ryan Poertner is a General Manager of Ace Pipe Cleaning, Inc. and lives in St. Louis, MO. Ryan manages the St. Louis office, as well as the Cured-In-Place-Pipe (CIPP) division within APC. Ryan is directly responsible for the safety and quality of work for these divisions. His main focus is on the growing market involving lateral rehabilitation. APC is a leader in the industry providing all types of investigation and rehabilitation solutions for municipalities in need. Ryan has spent his entire professional career working in the water and wastewater rehabilitation fields. Prior to the 9 years currently with APC Ryan spent 8 years working for Insituform Technologies, Inc. in roles as Engineer, Trainer, Estimator, and Project Manager. Ryan is an active member of NASTT, NASSCO, WEF and local engineering organizations.

MSTT BOARD EXECUTIVE 2021-2022

Robert Martin - *Secretary*

Robert Martin, P.E. has been with Jacobs Engineering Group since 2007 and has over 20 years of comprehensive underground engineering experience on projects including those for the rail transit, water supply, wastewater, and mining. Robert is the Past President of the ASCE Wisconsin Section Southeast Branch and was a contributor of the ASCE/ UESI Manual and Reports on Engineering Practice No. 106, Horizontal Auger Boring Projects, Second Edition. Robert's experience includes construction feasibility assessments, design of soft ground and rock tunneling using various methods including; drill-and-blast, road header excavations, full-face tunnel boring machines in rock and soil, microtunneling, horizontal directional drilling (HDD) and other trenchless methods and has worked on projects all over the world. Robert is an active member of NASTT in addition to his role as Secretary of the MSTT Board.

Gary Smolinski – *Treasurer*

Gary Smolinski a Construction Manager and Partner at OHM Advisors (OHM) with over 30 years of experiential knowledge in the construction industry. He manages the construction phase of projects by working with contractors and technical staff, developing solutions to problems that inevitably arise in the field. Gary is also a hiring manager at OHM, responsible for recruiting, hiring, and training future talent of field engineers, inspectors, and office technicians for OHM's Field Services (Construction) group. Using his expertise in the construction field, he works to continually enhance operational procedures, assigning and directing work accordingly to ensure the success of both the construction engineering teams and the client communities served. Committed to advancing both his own technical knowledge and the use of trenchless techniques, Gary has continued to be an active member of the Midwest Society for Trenchless Technology (MSTT) since 2013, and is an active member of the North American Society for Trenchless Technology (NASTT).

Jeff Boschert - *Past President*

Jeff Boschert, P.E. is the President of the National Clay Pipe Institute (NCPI), a not-for-profit organization dedicated to research, education, and leadership in the vitrified clay pipe sanitary sewers industry for more than 100-years. Jeff joined NCPI from Missouri DOT in 2004 to serve as the leader of the organization's trenchless initiatives. His initial research projects began almost immediately with CLSM bedding research.

Jeff has become a leading expert in the pilot tube method of guided boring. In 2012 he took on the added responsibility of leading NCPI and conducting educational outreach as the new president. In addition to his work with NASTT, he represents the industry on multiple ASCE and ASTM committees. Jeff was one of the principal authors of the ASCE/USEI MOP No. 133 on Pilot Tube and Other Guided Boring Methods and is currently serving as Vice-Chair of the ASCE/ UESI Pipelines Division Executive Committee (ExCom).

Under Jeff's leadership, NCPI has completed comprehensive updates of the Vitrified Clay Pipe Engineering Manual, the Vitrified Clay Pipe Installation & Inspection Handbook, and the newest update in 2021 - Analyzing CCTV Inspection of Vitrified Clay Pipe. In 2020, the organization introduced the all-new Vitrified Clay Pipe Operations & Maintenance Handbook. He holds a BSCE from Missouri University of Science and Technology.

MIDWEST SOCIETY FOR TRENCHLESS TECHNOLOGY
BOARD OF DIRECTORS 2021 - 2022

2022 SEMINAR & JOURNAL SCHEDULE

MASTT - MID ATLANTIC SOCIETY FOR TRENCHLESS TECHNOLOGY
MSTT - MIDWEST SOCIETY FOR TRENCHLESS TECHNOLOGY
SESTT - SOUTHEAST SOCIETY FOR TRENCHLESS TECHNOLOGY

SOCIETY	PROPOSED DATE	LOCATION	STATUS
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SESTT JOURNAL	DEC 9, 2022	PUBLISH DATE (DEADLINE (11/19/22)	PROPOSED

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Or call (204) 275-6946 to advertise in the journal or discuss an article for the journal.

Our 119 "Trenchless Technology, SSES and Buried Asset Management" seminars since 2001 have offered a lot of information, a lot of networking and a lot of learning. The journal and webinar are a great source for advertising, learning and teaching.

For registration and updated information on the 2022 "Trenchless Technology, SSES and Buried Asset Management" Seminars and Trenchless Journals, please visit:

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GOING THE DISTANCE

By B. Kerby Primm, P.E., CCI & Associates, Inc.

Installing a pipeline crossing beneath a sensitive resource over a length exceeding 15,000 feet may seem like a dismaying endeavor for the majority of companies. Even in ideal conditions, drilling over 15,000 feet of any diameter hole would be a formidable challenge for even the most experienced HDD driller. This challenging scenario came to realization as WBI Energy, Inc., a subsidiary of MDU Resources Group, Inc. (NYSE:MDU) (WBI) was selecting the route for a proposed 24-inch natural gas line that involved approximately 60 miles of new NPS 24 (24-inch O.D.) steel pipeline that would connect WBI's Tioga Compressor Station near Tioga, North Dakota, with Northern Border Pipeline Company's mainline at a new interconnection point south of Watford City, North Dakota. The pipeline is for natural gas takeaway to help reduce natural gas flaring in the area.

The selected route would require WBI to cross Lake Sakakawea adjacent to Tobacco Gardens Resort, near Watford City, North Dakota, and comply with requirements of the Garrison District of the United States Army Corps of Engineers (USACE) for horizontal directional drilling (HDD).

With HDD as the only practical method of installing a crossing of such substantial length, WBI enlisted the services of CCI & Associates Inc. (CCI) to develop a design that could be used to successfully traverse the lake. After reviewing the existing conditions, recently completed crossings and available details of the area, a preliminary HDD crossing design exceeding 15,000 feet in length was developed as a basis for subsequent site characterization efforts.

The selected route would require WBI to cross Lake Sakakawea near Tobacco Gardens to the south, roughly 24 miles north of Watford City, North Dakota

Geotechnical Investigation

Thorough understanding of subsurface conditions in the vicinity of any proposed crossing is essential to determining if a HDD crossing is technically feasible. While crossing length and pipe diameter are also critical components that must be considered, technical feasibility is largely limited by subsurface conditions.

The project team, consisting of WBI, CCI, and Groundwater & Environmental Services, Inc. (GES), as the geotechnical sub-consultant under CCI, completed a detailed review of the local geology along with developing a plan for completing both land-based and water-based geotechnical borings.

A review of the regional geology indicated that the physiographic regions where the proposed HDD pipeline crossing is located consist of the McKenzie Upland Unit, located south of the Missouri River and the Coteau Slope Unit, located north of the Missouri River. These units are part of the Great Plains and characterized by rolling to hilly plains with both erosional and glacial landforms. The proposed HDD crossing is located within the historic Missouri River floodplain that was flooded with the construction of the Garrison Dam in 1956 to form Lake Sakakawea. This area is located in the central portion of the Williston Basin.

The surface geology in the area consists of thin layers of glacial deposits underlain by the Paleocene-Aged Sentinel Butte Formation and the Bullion Creek Formation. The Sentinel Butte Formation consists of layers of silt, clay, sand, lignite, carbonaceous shale, and mudstone. The Sentinel Butte Formation outcrops along the south shoreline of the Missouri River and both the Sentinel Butte and Bullion Creek Formations outcrop along the north shoreline of the Missouri River along the proposed crossing alignment generally consisted of sedimentary bedrock overlain by alluvial deposits in the Missouri River channel and thin glacial deposits in the upland areas.

In April 2019, GES began work on two land-based exploratory borings near the proposed entry and one land-based boring near the proposed exit point locations, all of which extended to depths ranging from approximately 370 to 400 feet below the ground surface. These borings generally confirmed the results of the local geological review, showing evidence of sand, clay, and alternating layers of coal, and clay shale. Considering the results of the site-specific exploratory borings, the preliminary annular pressure (hydraulic fracture) analysis and the local geological review, the project team concluded that the subsurface conditions were conducive to the use of HDD.

Upon determination that the crossing was geometrically feasible and seemed likely to be geotechnically feasible based on

Barges were utilized for the completion of six geotechnical boreholes along the width of the lake, reaching depths of up to 315 feet below the bottom of the lake

One of CCI's drones used for drilling fluid release monitoring of the watercourse

the completed land borings, CCI recommended a further site-specific geotechnical investigation that included an additional six over-water-based geo-explorations to confirm technical feasibility.

Over-water geo-exploration began in April 2020 during a peak in the pandemic that year. Special safety precautions had to be outlined prior to mobilization. CCI worked with the owner, WBI, and its subcontractors to ensure these protocols were followed. Six borings were completed to depths ranging from 300 to 315 feet below the lake mudline. The program was successfully completed in May with no incidents of Covid-19 infections. Sub-surface conditions similar to those identified in the land-based borings were found in the over-water geo exploration. With the data obtained from the investigation, CCI and GES were able to identify the extent of the lignite seams detected in each boring and approximate the arrangement of these layers throughout the crossing alignment, ultimately aiding in the detailed design of the HDD profile.

HDD Design

CCI outlined the three key objectives to achieve WBI's primary goal which was to install a 24-inch steel pipeline beneath Lake Sakakawea with minimal environmental impact:

1) to create an HDD design that would maximize the constructability of the proposed crossing;
2) to minimize the risk of an inadvertent drilling fluid release within or adjacent to the lake; and
3) to provide a detailed design that was permittable by the USACE.

For the HDD crossing design, the entry point location was placed on the south side of the lake in a flat agricultural field

On October 23, 2021, the HDD and pipeline crews successfully worked together to pull the 24-inch welded steel pipe through the reamed hole, completing the crossing

With these goals in mind, the exit point location (pipe side) was placed on the north side of the lake where there was ample space that was ideal for pipe stringing and fabrication. The north bank had a long, reasonably flat right of way area that stretched out within the surrounding agricultural fields and would enable the contractor to stage the product pipe in two segments. Having only one short tie-in weld during the installation would decrease the risk of the pipe becoming stuck during pullback. One challenge for the pullback string layout was the crossing of Highway 17A. The decision was made to install a culvert beneath the road and pull the product pipe through rather than spanning above the road using cranes and/or Conex containers.

This installation, with a recorded length of 15,426 feet, marks a notable accomplishment in the HDD industry

For the HDD crossing design, the entry point location (rig side) was placed on the south side of the lake in a flat agricultural field. The design utilized entry and exit angles of 15 and 12 degrees, respectively, a radius of curvature of 5,000 feet, and a depth ranging between 245 to 290 feet below the lake bottom, resulting in a total length of 15,426 feet. Of that horizontal length, approximately 11,870 feet is the water course crossing beneath the lake. The portion of the drillpath under the lake also incorporated some minor vertical curves to maintain the drillpath within the favorable subsurface layers (out of the significant lignite seams detected in geo exploration).

With the crossing design completed, the pilot hole tolerances were set such that the contractor was provided a constructible design that had flexibility in case unexpected ground conditions were encountered. Considering the difficulties in accurately steering the pilot hole as the distance from the rig to the drill bit increases, providing greater than normal pilot hole tolerances and exaggerated vertical curves was key to increasing the chance of success on a long HDD installation.

Construction & Oversight

The chosen HDD contractor, Michels, began construction in early August 2021 and continued through late-October. CCI provided HDD inspection services to record and monitor annular pressure, pilot-hole vertical and horizontal radii, and provide water course monitoring with drone flights. The drones provided rapid and accurate visual inspection of the lake and shoreline for signs of inadvertent fluid releases to the surface.

> **"The success of the North Bakken Expansion project is a reflection of the dedication of WBI's employees, supporting contractors, and working alongside recognized industry leaders like Michels and CCI."**
>
> **- Jeff Rust Vice President Operations, WBI Energy**

Michels completed the pilot hole using the HDD intersect method, which involves drilling a pilot hole with two rigs from opposite ends of the crossing and ultimately intersecting borehole paths in a pre-decided location. After the pilot hole was successfully complete, Michels reamed (enlarged) the hole in multiple passes using a 24-inch hole opener then a 36-inch hole opener. On the morning of October 23, the Michels HDD and Michels Pipeline crews began pullback. By mid-day on October 25, the NPS 24 product pipe was pulled through the reamed hole, successfully completing the world record crossing.

Conclusion

Technology pushing, world record trenchless installations can be completed successfully when due diligence focused on proper planning, detailed design, and construction execution by experienced contractors are made a priority. The project team consisting of WBI, CCI & Associates, Groundwater & Environmental Services, and Michels worked together from the initial feasibility phase through the successful installation of the NPS 24 pipeline. "The success of the North Bakken Expansion project is a reflection of the dedication of WBI's employees, supporting contractors, and working alongside recognized industry leaders like Michels and CCI." Jeff Rust Vice President Operations, WBI Energy.

This installation, with a recorded length of 15,426 feet, marks a notable accomplishment in the HDD industry and demonstrates that seemingly infeasible crossings are achievable with the right team in place.

ABOUT THE AUTHOR:

B. "Kerby" Primm *has spent over 16 years as an engineer involved in multiple specialties including civil site design, transportation, and trenchless design. He is a Sr. project manager for CCI & Associates based out of Houston, TX.*

UNVEILING THE 1ST T-LINER®; NEARLY A QUARTER CENTURY LATER:

A Case Study on CIPP Innovation & Durability

By: Joseph Sullivan, Robinson Engineering, Ltd.
Chad Wilson, Performance Pipelining, Inc.
Thomas McGreevey, Performance Pipelining, Inc.

1. Background

Twenty-three years ago, and a long time before that, there was a need for a solution to leaking service laterals, especially at the mainline sewer connection. As many infiltration & inflow (I&I) professionals can attest, this is where a major component of groundwater/base infiltration enters a sewer system, needlessly taking up pipeline capacity and escalating wastewater treatment costs. Additionally, the need was for an innovative approach to fixing this piece of crumbling infrastructure where mainlines and service laterals were cracked, broken, and leaking beneath storm sewers, ditches, and swales.

It just so happened that the birth of a critical sector of the cured-in-place pipelining (CIPP) industry took place in a south Chicagoland suburb, on a project for the South Palos Township Sanitary District (SPTSD). The SPTSD had engaged Robinson Engineering, Ltd. (REL) of South Holland, IL to lead a multi-year, comprehensive sewer rehabilitation program. One of the project components involved rehabilitation of some 117 residential sewer service laterals.

The SPTSD is a small sanitary district in southern Cook County, IL that has approximately 67,000 linear feet of sewer and 750 homes. It's one of those places with large parcels with big front yards, and rural street cross sections where ditches and swales convey stormwater through the neighborhoods, making each sanitary service lateral crossing a potential weak

The first T-Liner revisited 23 years later by Robinson Engineering, Ltd.& Performance Pipelining, Inc.

The T-liner system helped to reduce wet weather flows by a factor of 8.0 times.

point in the aging sewer system. These weak spots under the ditches were largely due to the original construction materials used for their service laterals, which were 6-inch diameter vitrified clay pipes, with each 3-foot section often just butted up to the next section without proper joint connections. These loosely connected joints created channels that often-allowed groundwater and surface water a direct pathway into the sanitary sewer system.

Robinson Engineering, Ltd. (REL), founded in 1937, is a 160-person, full service civil engineering firm located in the Chicago suburbs with over 100 municipal clients in the Chicagoland and Northwest Indiana markets. Over the years, many of these clients have looked to REL to be their subject matter experts for Sanitary Sewer Evaluation Studies (SSES) and I/I reduction programs, relying on them to seek out new rehabilitation methods and technologies to benefit their aging infrastructure.

In 1997, faced with a consent decree and with an IEPA loan in hand for their rehabilitation project, the SPTSD & REL set out to rehabilitating the service laterals that were crossing the ditches in a manner never before attempted. In the 1990s, lateral lining was still in its infancy, and was somewhat unproven as an effective method for rehabilitation when compared to traditional open-cut pipe replacement, a "Base Bid" for traditional open-cut and an "Alternate Bid" using trenchless methods were both put out for solicitation.

Performance Pipelining Inc. (PPI) of Ottawa, IL submitted the successful Alternate Bid, and was awarded the project based in large part on its promise to minimize surface disruption while solving the service lateral I/I problem. Lateral liners were installed from small excavation pits at the property line and directed toward the sewer mains with a small portion of the lateral liner left protruding into the main. PPI then went back and cut the protruding liner ends in the mainline with an internal cutter like those used in main line CIPP applications. To finish, they installed a cleanout just upstream of the lateral liner's terminal edge. Although structurally sound, this method left small gaps at the connection point that allowed interstitial flow to enter the sewer, thereby giving infiltration a pathway back into the newly rehabilitated sewers.

Meanwhile, Larry W. Kiest, owner of LMK Technologies and Performance Pipelining, and his team were working hard preparing an innovative solution to the remaining I/I problem at the lateral-main connection point. Midway through the project, PPI offered their new innovation to the district engineer, Aaron Fundich, P.E. of Robinson Engineering: the first single-piece full wrap mainline and lateral CIPP Liner

UNVEILING THE 1ST T-LINER; NEARLY A QUARTER CENTURY LATER

	Early Adopters (T-Liner Installs)						
Year	1998	1999	2000	2001	2002	2003	To Date
South Palos Township Sanitary District	80						450+
City of Naperville				100			2,000+
DuPage County						50	500+
Fox Metro Water Reclamation District						1,000	1,000+

installed from the mainline with no excavation whatsoever. All they needed was a cleanout to access the lateral and a manhole to access the mainline. It was called "The T-Liner®".

With this being a completely new product and process at the time, the appropriate sign offs, and assurances had to be made before the product and the innovation were given the green light to be used. Robinson and SPTSD required that the rehabilitated laterals be reinspected using CCTV while the ditch was flooded with dye. The contractor was responsible for all costs if the liner leaked and was required to maintain a 3-year maintenance bond after construction to guard against the potential for the T-Liner to not remain in place over time.

The first T-Liner install, which occurred on Meadowlark Lane in Orland Park, IL, on March 4, 1998, was deemed a success and with approval from the SPTSD, PPI went on to install 80 more T-liners to finish the project.

The T-liner system solved this long-standing problem and helped to reduce wet weather flows by a factor of 8.0 times, bringing them back into compliance with Illinois Environmental Agency, IEPA and the Metropolitan Water Reclamation District of Greater Chicago, MWRDGC.

2. Early Adopters

Since then, the patented T-Liner has been approved by many engineering firms and hundreds of municipalities, giving it one of the most recognized names in the sewer rehabilitation industry. Some of the early adopters of this technology include the South Palos Township Sanitary District with over 90 T-Liners installed before 2001, the City of Naperville, IL with nearly 100 T-liners installed by 2003, and many more since then.

3. Evolution Of An Industry

Since those early installs, the T-Lining industry has boomed to include over 50 licensed installers. Many engineering firms and municipalities now specify the T-liner as their preferred solution for their mainline to lateral connection repair. Some people in the industry might even know that their specification reads LMK, T-Liner or "equal", not knowing that the "L" and "K" are the initials of Larry W. Kiest, the founder and inventor of the T-Liner, and that the T-Liner was just one of the many sewer repair solutions he invented over the past 30 years.

Nowadays, the list of innovations from LMK are nearly as long as their history and include the following products:

1. **T-Liner (Shorty, Stubby & Traditional) ASTM F2561**
2. **Hydrophilic gaskets (Insignia O-rings™, Insignia Hydro Hat™, Insignia End Seal™) ASTM F3240**
3. **Vac-a-tee® ASTM F3097**
4. **LMK LMT (lined main tap saddles)**
5. **LMK CIPP Mission couplings (For CIPP to other materials)**
6. **Lapel Liner (for service connection repairs in > 24" mains)**
7. **Siamese cross connection lateral liner**
8. **Double Stack connection lateral liner**
9. **CIPP manhole products ASTM F3033**
10. **Performance Liner® Inverted Sectional Liner ASTM F2599**

In addition to the many products that now accompany the T-Liner, many of these products are covered by Five (5) ASTM Standards that are recognized as industry standards. The International Plumbing Code also requires compliance with ASTM F3240, F2599, and F2561 for any CIPP lining installation made in buildings or where the plumbing code has jurisdiction. That all requires trained installers and today there are more than 50 companies with 60 install crews licensed to install the T-Liner. They have been installed in

Preparing for inspection nearly a quarter century later

all 50 states, (37 of which were worked on by PPI), and in 14 countries around the world including the U.S., Canada, Mexico, Singapore, Australia, Germany, Denmark, UK, France, Poland, Turkey, Brazil and Guam. With now more than 200,000+ installations to date worldwide, it continues to be the premier solution for failing service laterals and for forming a watertight connection to the mainline CIPP liner. Other companies have even come up with their own version of the T-Liner including, the "Main to House" (MtH) liner by Trelleborg & the "Service Connection Seal plus Lateral" (SCS+L) CIPP lining system by BLD Services, LLC who purchased the lateral lining division from Insituform Technologies, USA, as well as others.

Performance Pipelining Inc. has been part of this evolution since the beginning. Incorporated in 1991, PPI was the very first LMK licensee of their patented technology installing the first T-Liner in 1998 and the first steam cured T-liner in 2003. Since then, PPI has seen many changes now installing Shorty T-Liners and Stubby T-liners as well as becoming a veteran owned business with new ownership in 2014. Their company now has 46 full time employees, offices in Illinois and Pennsylvania, and is currently running 10 separate install crews that have worked in 40 out of our 50 states. To date PPI has installed more than 50,000 T-liners and holds the world record for installing the longest (200 continuous feet) CIPP Liners from a main pipe with no excavation.

The good news was that the T-Liner is still structurally sound, it looked great.

4. How The 1st T-Liner Has Held Up

So, nearly a quarter century and 200,000+ T-liner installs later, we decided to go back out to SPTSD and re-inspect the first T-liner that was unveiled nearly a quarter century ago to see how it is doing. In a matter of a couple weeks, with approval from the SPTSD Board of Trustees, REL & PPI, the original T-Liner installation was re-inspected on June 2, 2021.

Excitedly, the team assembled onsite nearly 24 years later, this time with all new faces, but still representatives from the same original two companies that were there in the beginning, and still with a representative from the District, Steve Carr the Sewer Supervisor.

While setting up for the inspection, it was apparent that the ditch crossing over the sewer lateral is one of the reasons this technology and solution was needed so badly in the first place, so we instinctively put green, fluorescent powdered dye into the wet ditch crossing to simulate the dyed water testing that was originally used to identify these failing laterals and to re-test these connections post rehabilitation.

Right away, as the camera was lowered down into the manhole there was a sigh of disappointment and we found that the mainline sewer itself was CIPP lined since the first T-liner install, so the full wrap portion of the T-liner was not as visible as it once was. Shoot! Nevertheless, Cole Ewers & Lance Rentz, the two TV technicians with PPI, drove the camera up the sewer main seven feet from the upstream manhole.

As the camera continued the crew could see a bit of the indentation from that original full circle wrap mainline portion of the install which was now almost completely underneath the mainline CIPP liner.

Green fluorescent dye was used to simulate the dyed water testing that was originally used to identify the failing laterals

The first T-liner, mainline piece only slightly visible under a subsequent mainline CIPP installation

The first T-liner, mainline piece at time of original installation

As Lance panned up the service he said, "Oh no, there's a gash.", revealing a golf ball sized hole at the re-instatement of the lateral connection where a subsequent main line lining company that followed the original T-Lining work had inadvertently cut through that first T-liner. The good news was that the T-Liner is still structurally sound, and this defect could be repaired by performing a service lateral air test and lateral grout using a chemical grout or a similar type of sewer grout compatible with a lateral grouting packer assembly.

Despite this observed post-installation gouge, the camera crawled on to complete the LACP inspection of the first T-liner. Apart from a couple wrinkles that nowadays a perfectionist Owner or unrealistic Engineer might put on a punch list, it still looked great. It is doing its job; it has held up over time and the terminal liner ends are intact. Furthermore, the ditch was flooded with green dye and there were no leaks observed during inspection, and that was the whole point to begin with.

A golf ball sized hole in the first T-liner where a mainline lining company gouged too deep during service lateral reinstatement

To recap, the view of that first T-liner was bittersweet. While it is still functioning, intact, structural, and doing the job that was intended, we all had hoped to see the main line wrap portion still visible and would've preferred no holes added over time. Seeing a previously installed T-Liner damaged by a mainline lining company was a lesson learned over time by many sewer rehabilitation professionals. For this very reason, T-liner projects today almost always have the T-liner installation sequenced after the mainline CIPP is completed.

The first T-Liner was installed long before the invention of the VAC-A-TEE, a minimally invasive system for installing a cleanout through a 24-inch vacuum excavated bore hole. Therefore, back in 1998, when a cleanout didn't exist, one was installed by conventional excavation (using a backhoe). So even though it was the first T-Liner installation, it actually had a cleanout in the homeowner's garage. The homeowner was very cooperative and helpful in making it available for the PPI crew to use and to make history.

5. Conclusion

In conclusion, the T-Liner has really found its place in the CIPP and sewer rehabilitation industry as the premier solution to renewing service lateral pipes and the broken main/lateral connection. It has served its purpose well in South Palos Township Sanitary District for nearly 24 years with some dings, dents and a hole poked in it along the way. Since then,

communities all over the country and even around the world have adopted this rehabilitation technique and the numerous advances made over many years.

We really enjoyed going back and looking into the past at these first-generation T-liners and hope you enjoyed reading about them as well. It's good to know that these original T-Liners along with a large number of the T-liners installed by the early adopters will continue to serve the utilities in which they were installed well and deliver on that extra 50 to 100 years of design life that they are designed for.

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LESSONS LEARNED ON CHALLENGING PTM PROJECT

Pilot Tube Method Effective Trenchless Option in Novi MI

By: Steve Matheny P.E., Logan Clay Products LLC,
Greg Marker P.E., OHM Advisors

Novi is a growing area 25 miles northwest of Detroit. In one area of this community, there was an existing 20-year-old, six-inch force main that was functionally obsolete carrying the outflow from two separate pump stations. Multiple single grinders also fed into the one pipe resulting in regular failures of the force main. Replacement of the force main would have required significant capital investment for multiple new mains, limited future growth and continued to be a costly maintenance headache.

The project is designed to replace more than 1.5 miles of the existing force main. The new 12-inch diameter gravity sanitary sewer will separate the two force mains from two upstream pumping stations, ultimately delivering a lower lifecycle cost. The new increased capacity will also create the opportunity for current parcels (with existing septic systems) and future developments to tie into the municipality's gravity sewer.

This project area featured large parcels in a naturally beautiful surrounding with mature trees lining the roadway. The road is classified as a Natural Beauty Road by Oakland County, and there is an abundance of landscaping in the right-of-way with natural ponds throughout the project corridor. All these features were viewed as community assets that needed to be respected and protected. The mature trees and landscaping also created an extremely tight project corridor for operations.

To preserve the community assets while keeping costs down, a multi-method project plan was developed using both open-cut and trenchless installation methods. The new gravity sewer line would provide the expanded capacity needed to serve a growing population in the area while addressing the ongoing environmental, maintenance, and cost concerns that accompany lift stations, force mains, septic fields, and grinder pumps.

The bid documents allowed for the use of horizontal auger boring or, as an alternate, Pilot Tube Method of Guided Boring (PTM) for the trenchless runs. The contractor bidding PTM was the most competitive bid for the trenchless portion of the project.

The contractor elected to use PTM with Vitrified Clay Pipe (VCP) because of previous experience. Shaft construction and installation, including dewatering, using PTM was more economical than traditional jack and bore methods because of the reduced shaft size and the permanent pipe installation without an oversized carrier casing, on grade spacers, and grout.

Results of 18 soil borings in the 7,400-foot alignment were included with the plan documents. That was one bore approximately every 500 feet. Because the soil layers were roughly consistent, additional borings were deemed unnecessary. The borings indicated that on the east end of the project the soils were

Aerial view of the 9 Mile Road Sanitary Sewer Project area in Novi, MI

Nested cobbles from one run

Maximum cobble size that can be "digested"

"moist gray clay with some silt and traces of sand or gravel." This description was present in 14 of the original 18 borings. This was the area planned for trenchless installation.

On the west end of the project "gray sands" were in the profile of the installed pipe. This was the area planned for open cut installation where depth of sewer was less, the natural beauty designation was not present, and the foliage cover in the Right of Way (ROW) opened.

Dewatering was a key component of the project. The area has multiple wetlands and a high-water table. The dewatering narrative was written based upon the soil borings, geotechnical report, and site-specific review letter from the Michigan DEQ (now known as EGLE – Environment, Great Lakes & Energy). The review letter based on the original dewatering permit application included a limitation of two MGD (Million Gallons per Day) of discharge.

The dewatering plan was designed to limit pumping and stay below this maximum. The plan anticipated that the deep wells would lower the existing water table and allow the construction of temporary shafts over a period of two to three weeks. The expectation was that this would lower the water level to below the invert of the pipe for open cut trench construction. The deep wells were intended to eliminate water in the jacking shafts and the well points would lower the water-table to within six to ten feet of the top of pipe for the trenchless operations.

The PTM process based on the dewatering narrative should have allowed for operations to be conducted simultaneously with open cut operations because of the ability to tight sheet the shafts. The construction plan for this project was designed to take advantage of the precision of PTM installation with ongoing dewatering throughout the project. The plan anticipated pumping of 1 – 1.5 MGD in up to six deep wells and shaft pumps in the east end of the trenchless sections and 0.5 - 1 MGD from the well points in the open cut areas. After initial setup of four of the 14 planned dewatering wells, two MGD was immediately reached with the water table plateauing at six to twelve feet above the invert.

While the dewatering permit was reevaluated, the two MGD limit in the partial permit was used entirely for the well points in the open cut portion of the project. To stay within the two MGD limit, work began only in the open-cut area of the project while an application was made to expand the project's dewatering. The new permit allowed for up to 8 MGD. A larger header system was installed to allow trenchless installation to commence with an average of 5 MGD used to provide adequate dewatering.

On the first few runs, a 16-inch open face reamer head following the 5-inch pilot tube functioning as planned. The third run was the first indication of problems as ground water moved soils around the head and along the profile.

As run three progressed, it became clear that a more aggressive solution would be needed. Multiple variations in the soils were encountered. The clay layer varied in depth, drifting up and down intermittently in the boring profile creating a mixed face condition where sand would change to clay and back again, sometimes multiple times in the same run. Along the interface between the clay and sand layers throughout the project was a nested cobble layer that varied from 6 inches up to three-feet-thick with heavy percentages of coarse sand (up to 40 percent in two areas).

The clay would slow open face reamer heads. The sand would cause sediment migration along the bore profile where ground water wasn't fully controlled. The nested cobbles (3 to 12 inches) would stop the pilot tube or boring heads, causing considerable delays. Pauses in auger rotation and "slamming" of the casings permitted the swivel bearing cutter head to accept the smaller

Mincon rock hammer pilot head

cobbles and grind them up in the front chamber, allowing them to be transported back to the jacking shaft.

The switch to a swivel bearing cutter head and chamber started to achieve results. However, the high groundwater also moved soils along the alignment in the coarse sand area. Temporary casings were replaced with permanent welded casings; however, a shear break created a misalignment. Ultimately that run had to have a 36-inch heavy-walled casing hammered in around the 16-inch casings to restore the design slope across the offset alignment. The casing was pulled out using an Akkerman Guided Boring Machine (GBM). After the 36-inch casing was cleaned and profiled, the carrier pipe was installed on grade, and the annulus was grouted.

After ten additional soil borings to clearly identify geotechnical conditions along the alignment of the remaining ten planned runs (MH ten down to existing), and with the larger dewatering system in place, PTM installation resumed with a swivel bearing cutter head. The method was successful from MH 10 to MH 5.

Dewatering was a key component of the project. The area has multiple wetlands and a high-water table.

When the second area of course sand was encountered in the area of MH 5, Akkerman manufactured fittings for the pilot tube system to use the rock tooling provided by Mincon. This allowed continued use of the pilot tube optical guidance while also adding a directional drill sonde to verify the alignment and elevation when the optics were clouded by the dust and vibration of the rock hammer pilot head. The new fittings allowed precise drilling from MH 5 to 4 through the nested cobble, coarse sands, and a high-water table.

The inability to get a pilot tube from 3 to 4, resulted in an additional shaft 3B. After the installation of the pilot tubes from MH 3B to 4 with the Mincon rock hammer, DVM Utilities provided a 16-inch plate reamer leading a 16-inch casing that was unsuccessful in achieving line and grade through the nested cobble layer. Ultimately a 30-inch hammered casing swallowed the 16-inch welded casing and the 12-inch sewer was installed and grouted using profile spacers to maintain grade inside the casing.

The last five runs of the project profile drifted between clay, sand, and the nested cobble layer with fluctuations occurring, sometimes in intervals of less than 50 feet. The pilot tube achieved line and grade followed by a welded 16-inch heavy wall casing for successful installation through the mixed face condition. The pilot tube was changed out for 4.5-inch diameter rock drilling rods, then power auger reamed with 16-inch welded casing following. This proceeded until rock or nested cobbles stopped the operation. The augers were removed, and a hammer drove the 16-inch assembly following the rods to the next pit. From MH 3B to 3, the 16-inch casing was jacked out with 12-inch VCP. In the remaining runs, the jacking pressures exceeded 220 tons and the 16-inch casing is being left in place and CIPP lined.

With ten trenchless runs completed, and run 11 and 12 currently in progress, the largest, most important lesson learned has been teamwork! It may seem that you've heard that one before, but the importance cannot be overstated. Clear, consistent communication was an important element in making a team that held together in the face of adversity.

Don't push the boundaries. For any trenchless installation, the guidelines for geotechnical evaluations provided in ASCE MOP 133 should be viewed as conservative, but advisable. The additional soil borings called for in the standard, may or may not

The largest, most important lesson learned has been teamwork! Experience & expertise cannot be over-valued.

have unveiled the challenges before manpower and equipment were on-site, but the chances of uncovering issues would have been increased.

NO-DIG VCP Jacking pipe is the most-common choice for any PTM project. In this case, VCP's high compression strength (18,000 psi) and greater jacking pressures (78 tons with a 2.5 Factor of Safety) were fully exploited.

Experience & expertise cannot be over-valued. The members of this team, from the city and the design engineer to the contractors and equipment manufacturers all brought something to the table when it was time to problem-solve. When additional expertise was needed, each member of the team brought their resources to the table to grow the team on an as-needed basis. Applying the lessons learned from various other projects allowed the contractor to maximize the use of its GBM to solve problems in many ways.

The bottom line is: You never know when or how a project will surprise you. Make sure all the members of the team will partner with you to find solutions!

ABOUT THE AUTHORS:

Steve Matheny P.E. *joined Logan Clay Products LLC as a business development engineer in 2016 after more than 30 years in the field, working for municipalities and manufacturers. Steve is currently consulting on multiple projects throughout the Midwest & East Coast. Many of those projects will employ the Pilot Tube Method for installation. Steve's Bachelors and Masters degrees in Civil Engineering are both from Wayne State University.*

Greg Marker, P.E. *is a Practice Leader and Project Engineer for OHM Advisors. Greg is an underground expert that who stays on the cutting edge of trenchless technology, and is an expert in footing drain disconnection, foundation drainage issues. He is also an expert in traditional open cut construction of drinking water, storm, and sanitary installations, and a leader in Miss Dig and construction.*

PHASED APPROACH TO FORCE MAIN FAILURE SAVES MILLIONS:

Village of Hanover Park IL

By: Cathy Morley, PE, PD, RJN Group, Inc.

Force mains present a unique set of challenges that make inspections, assessment, and rehabilitation difficult and as a result are often expensive to maintain, inspect, and repair. Force mains are often not constructed with any redundancies and are often critical assets for a municipality, meaning they cannot be taken out of service for any significant amount of time without additional bypass pumping or the risk of overflows and customer service disruption. In addition, force mains typically have a limited number of access points for inspection or maintenance tools and have a higher risk of failure than gravity sewers because they are pressurized systems. There are also a limited number of inspection and rehabilitation technologies available. Because of these limitations, it is important to understand the mechanisms of a failure and undertake a multi-step process to investigate, determine vulnerabilities, and possible repair to replacement to avoid unnecessary spending.

For short length force mains this is not an issue as the cost to replace is probably less than the cost to analyze the reason why a force main has failed. However, with large diameter and/or very long forcemains the cost of the necessary bypass is so large that a phased approach to the investigation of a failure, while expensive in the short-term, can result in significant cost savings for the overall repair of the pipeline.

A 16-inch sanitary forcemain was installed in 1999 in the Village of Hanover Park, IL. This force main (approximately 17,300 feet long) was designed to transfer the flow from a treatment plant that was being decommissioned to their main wastewater treatment facility (WWTP). It was constructed through various types of land profiles – under a river, through a landfill and Forest Preserve District property. There are multiple high and low points throughout the pipeline.

On August 2, 2013, the force main ruptured at approximately 15,100 feet. The pipe segment was repaired but the adjacent sections of pipe had also deteriorated and about 120 feet of unlined ductile iron pipe was installed. This repair was a temporary fix to allow for continued operation of the force main. Fortunately, the break occurred during dry-weather flow conditions, and the 37-foot wet-well and adjacent 100,000 gallon storage tank located at the lift station were used as reservoirs during the force main shut down.

RJN was retained by the Village to analyze the break history, provide recommendations for investigating the condition of the remaining force main, determine the likelihood of additional points of failure, and its need for replacement.

Figure 1. Failed pipe

As part of the Phase I investigations, RJN performed a review of the system operation, specifically regarding the method of pipe failure. Field investigations were conducted to better understand the force main failure, the access limitations for Phase II inspection technologies, and to inspect a section of corroded pipe from the failure (Figure 1). The pipe from the previous break did not exhibit any pitting or exterior corrosion, which confirmed the Village's suspicions that the failure was the result of internal corrosion. It was apparent on viewing the pipe that the failure mechanism was hydrogen sulfide corrosion.

The estimated retention time of the wastewater from the wet well to the wastewater treatment plant is typically between eight and nine hours depending on the season; during drought conditions this retention time is estimated to be even higher. As a result of the high retention times, the wastewater turns septic and the pipe is susceptible to corrosion from those conditions. Internal knowledge from Village staff indicated that the force main was originally designed to accommodate anticipated growth, which would have significantly reduced the wastewater retention times.

A review of the pipe specifications indicated that epoxy-lined pipe was to be installed at certain locations to protect the pipe

It is important to evaluate the cost of inspection versus the risk of failure.

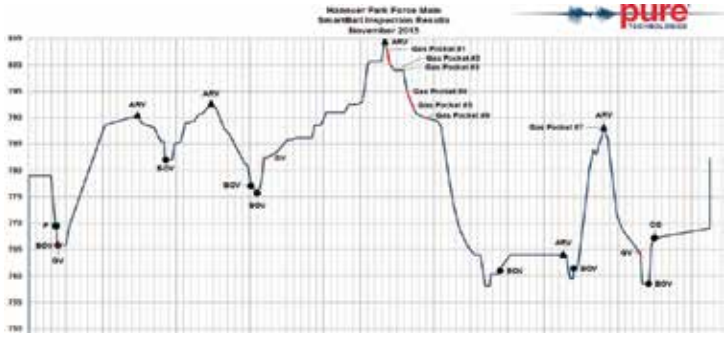

Figure 3 – SmartBall Results

from internal corrosion. Three different coatings were specified; two of the specified coatings were coal-tar epoxy derivatives and the third was a ceramic epoxy coating. Given that the ceramic epoxy coating is highly resistant to chemical attack, it is likely that the installed pipe was not coated or was coated with one of the coal-tar epoxy products.

For the Phase II inspections it was important to the client that any other areas of vulnerability be identified. There were four high points on the forcemain and as expected the break had occurred at the furthest which would be anticipated based on travel times and increasing septicity. The importance therefore was to locate additional anomalies and gas pockets which could lead the pipeline to be vulnerable. Internal evaluation of force mains is expensive, however the cost to replace the entire pipeline, which was only 15 years old, was estimated to be between $8 and $10 million. After evaluating different technologies, the Village retained Pure Technologies to undertake a SmartBall® inspection.

The SmartBall® tool uses acoustic technology to locate leaks and gas pockets. The tool allows the force main to remain in service and insertion could be performed using existing access points on the force main. This would act as a screening tool and depending on the inspection results, would require additional follow-up inspections in the form of ultrasonic thickness testing or Broadband Electromagnetic (BEM) testing.

Figure 2. SmartBall®

The SmartBall® inspection identified 7 gas pockets and 48 pipe wall anomalies ranging from small to large. The single large pipe wall anomaly identified was in the vicinity of previously repaired pipe at the location of a clamp. Six of the seven identified gas pockets were located between 9,075 ft. (also an Air Release Valve (ARV) location) and 10,400 ft. (See Figure 3). This section of the force main also drains during pump station shutdown periods making it more likely to be subject to corrosion. The inspection confirmed the evidence gathered during the Phase I investigations and pinpointed the target areas subject to corrosion for additional wall loss evaluation.

For Phase III Inspections the three options proposed to the Village for wall loss evaluation were ultrasonic thickness testing, Broadband Electromagnetic (BEM) testing, or coupon sampling. All three techniques required excavation. Ultrasonic thickness testing was eliminated because the inspection results are so localized, and the inspection tool surface area is so small; the tool is not efficient for scanning any significant length of pipe. The Village also did not want to perform destructive testing in the form of coupon sampling. So, BEM testing which can detect relative wall loss with external access to the pipe, was selected to determine the pipe wall loss at the target areas identified from the previous inspection.

Figure 4. Location of BEM inspections

Four sites were initially chosen for BEM inspection as shown in Figure 4 and listed in Table 1. During the inspection process, the ARV vault had a significant amount of hydrogen sulfide gas present, was not safe for entry and was therefore not inspected.

Table 1. Sites selected for BEM inspection based on the SmartBall® results.

Site Number	Location Description	Distance from Insertion (Based on SmartBall® inspection) (Feet)	Approximate Pipeline Invert elevation from Drawings (Feet)
1	ARV at 90+75	8,859	803.1
2	Gas Pocket #1	8,913	800.8
3	PWA Anomaly	9,397	797.5
4	Gas Pocket #5	9,604	792.2

During the inspection of Site 2, a leak was found when crews noted small air bubbles escaping the pipe. The area had already been scanned with the BEM equipment; however, the area was rescanned the following day just downstream of the repair sleeve that had been placed over the leak. Figure 5 shows a photo of the leak.

Figure 5. Leak discovered at Site 2 – Gas Pocket 1 during the BEM inspection

Table 2. BEM inspection results.

Location / Site Name	Nominal Wall Thickness (inches)	Minimum BSI (%)	Maximum BSI (%)	Average BSI (%)	Minimum Apparent Wall Thickness (AWT) (inches)	Average Apparent Wall Thickness (AWT) (inches)
Site 2_Gas Pocket 1	0.400	59	89	80	0.236	0.319
Site 3_PWA Anomaly 2	0.400	91	98	95	0.366	0.378
Site 4_Gas Pocket 5	0.400	100	106	104	0.402	0.414

Table 2 shows the BEM inspection results by BEM Signal Intensity (BSI) measurements and corresponding Apparent Wall Thickness (AWT) based on a nominal wall thickness of 0.400 inches for the three inspected sites. Figures 7 and 8 are visual representation of these results.

There was a 30 percent variation in the BSI minimum and maximum values at Site 2, which is significant based on the wall thickness pattern and its proximity to a known leak. There is minimal variation in the BSI values collected at Sites 3 and 4. There is no evidence in the Discrete and Localized Anomaly (D&LA) that indicates an increased possibility of a discrete flaw within any of the scanned areas.

Figure 6. BEM Inspection

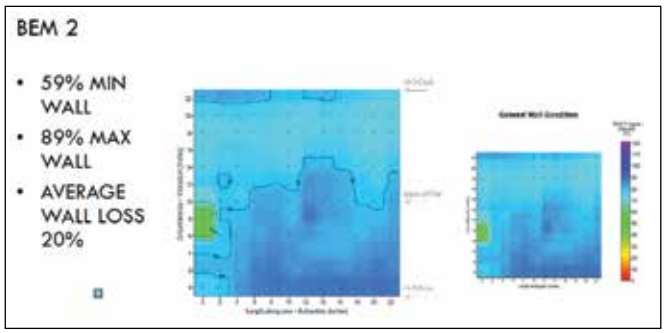

Figure 7 – BEM Results Location 2

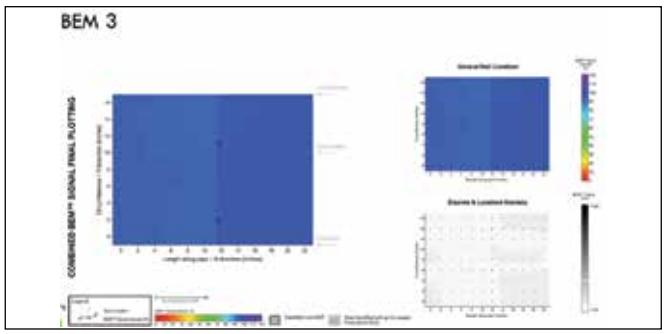

Figure 8 – BEM Results Location 3

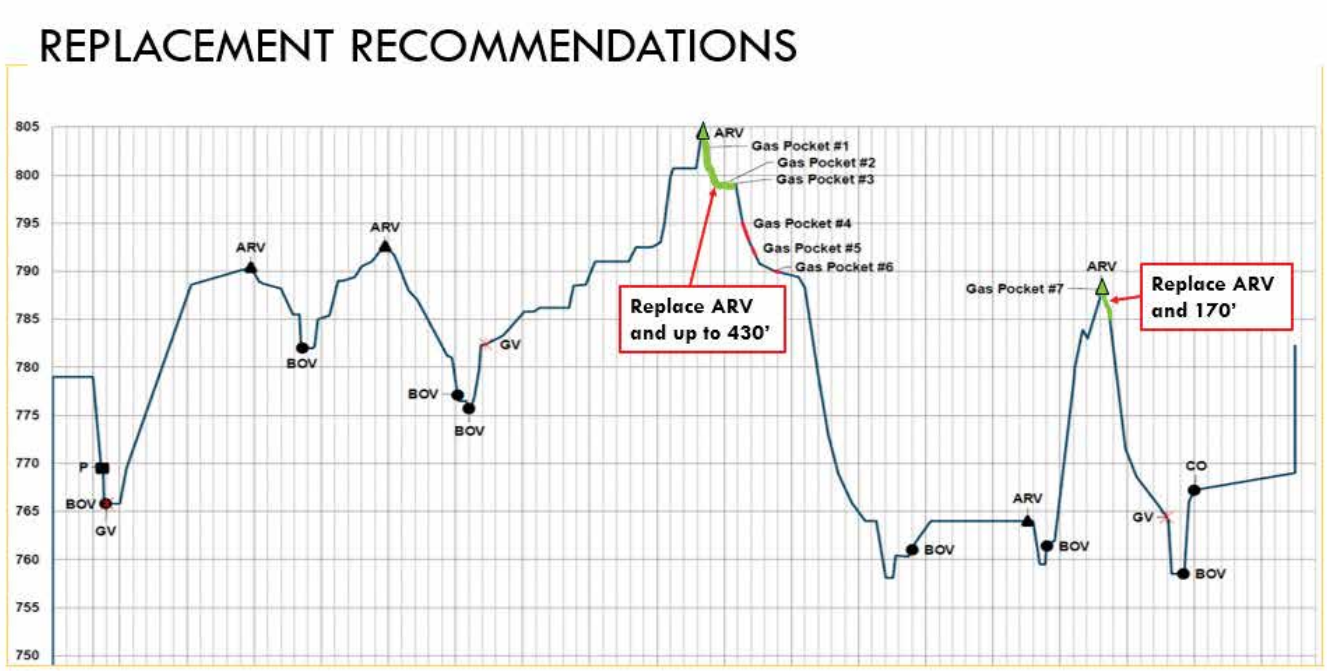

Figure 10 – Replacement Recommendations

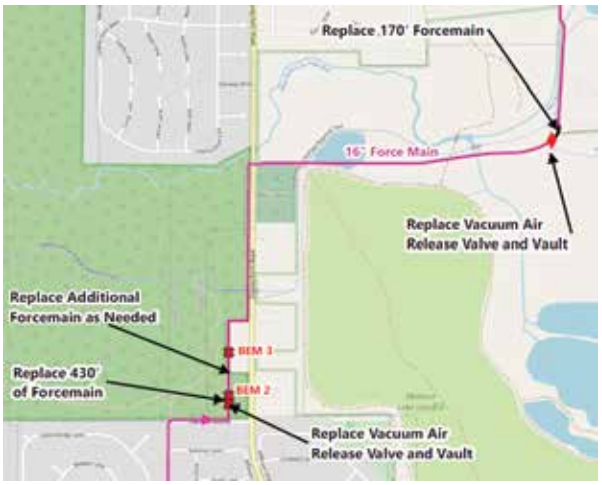

Figure 9 Final Recommendations to the Village

These results showed that not all the pipe is at risk, but that replacement should be prioritized in two areas. The final recommendations to the Village were:

1. The emergency repair of 2013 should be replaced with PVC pressure pipe. This repair should also include the replacement of an additional 50 feet of pipe, which would extend the repair from just before the air release valve vault to the south to the location where the force main is fully submerged to the north. In total 170 ft. is scheduled to be replaced.
2. Based on anticipated condition, approximately 430' of force main in the vicinity of BEM excavation No.2 should be replaced with PVC pressure pipe. Additional pipe may be replaced if adjacent excavated pipe shows deterioration.
3. The combination vacuum/air release valve vaults are unsafe for entry, inspection, and maintenance. The two vaults where the hydrogen sulfide conditions are most prevalent should be replaced with larger polymer concrete structures that will enable the force main to be safely vented while accessing the chamber for maintenance.

Conclusions:

- While force main inspections can be expensive it is important to evaluate the cost of inspection versus the risk of failure and the cost of full or partial replacement.
- Using a multi-step inspection process ensures that only inspections appropriate for the pipeline are used to minimize unnecessary cost
- Replacement/rehabilitation of a long force main can be very expensive because of bypass and constructability issues
- Understanding the vulnerability of the asset and planning for repairs minimizes emergency costs and results in an efficient use of funds.

ABOUT THE AUTHOR:

***Catherine Morley** is a Senior Project manager for RJN Group Inc. She is a graduate of Imperial College London and has more than 35 years of experience in municipal engineering, with a specialty in wastewater rehabilitation.Her recent focus has been on trenchless approaches for wastewater infrastructure. Projects have included design, construction and rehabilitation of sewers using micro-tunneling, pipe bursting, directional drilling, pipe jacking and lining.*

BROOKPORT LEVEE CULVERT RELINE: BROOKPORT, IL

By: Gaelyn Cunningham, Contech Engineered Solutions

Technical Description:
- **Product: ULTRA FLO® ALT2 spiral rib pipe, 12-gage**
- **Diameter: 60-inch**
- **Length 223.8 LF**

Installation Date: Fall of 2018

The original construction of the Brookport Levee, located in Illinois, began in 1940. In 1949, the City of Brookport took over the operation and maintenance. For decades, the levee continued to function as intended. However, in 2018, the City of Brookport began the process of repairing the Brookport Levee. The U.S. Army Corps of Engineers (USACE) had previously declared the levee unacceptable and stated that the levee should be repaired as quickly as possible. In its current state, it placed the town and its residents in jeopardy should any flood event occur.

The inspectors cited major problems with the structural integrity of the levee. The drainage pipes installed during construction had performed well beyond their intended service life and were in need of replacement or reline. The USACE Louisville District Office requested that these issues be corrected before the agency would be able to declare the levee's ability to hold back flood water to an acceptable level.

Originally, the city considered a complete removal and replacement of the culvert. Over the decades numerous trees had grown up along the levee banks, and the cost to excavate, remove and replace the existing pipe was well outside of the original budget for the project. With a population of just over 1,100 people, the city did not have the tax base to consider this option. Instead, they

The liner pipe is inserted into the host pipe utilizing a push/pull method

Contech provided a preconstruction meeting to outline the installation details while also providing onsite assistance.

turned to alternative repair options that would meet the USACE requirements.

The project engineer, Brown and Roberts, Inc., reached out to Contech® Engineered Solutions for a solution. Contech presented several options and ultimately, a 60-inch ULTRA FLO® ALT2, 12-gage culvert was selected to reline the existing culvert, addressing the failure, while limiting any road closures to the site and saving the City of Brookport a significant amount of money. The unique profile of ULTRA FLO® with a ¾-inch x ¾-inch x 7-½-inch corrugation would provide a Manning's "n" of 0.012 while the structural design would easily meet the height of cover (HOC) requirements of 62 feet with an HL-93 live loading. The city also chose to further protect the pipe by adding zinc chromate paint to the pipe exterior (the yellow coating on the pipe). The purpose of this extra protection was to protect the aluminized coating from the flowable fill during the curing process.

A screen on the pump hopper should always be used to sift out any large aggregate that can clog the grout line and potentially damage the structure

The lightweight characteristic of ULTRA FLO allows for longer lengths and ease of installation

The ULTRA FLO® culvert was manufactured at a nearby Contech facility and delivered directly to the site. A grouting plan was developed that ensured the annular space between the reline pipe and the existing pipe was completely filled with grout for the full length of the structure. Additionally, Contech provided a preconstruction meeting to outline the installation details while also providing onsite assistance throughout the entire process.

The upstream end of the culvert was restricted, which required a longer placement length for the ULTRA FLO® liner pipe, which – in turn – required a longer push distance. Fortunately, the lightweight character of the spiral rib liner pipe allowed it to be manufactured in lengths of 25 feet which required fewer joints as well. The contractor was able to overcome the longer lengths through the host pipe by lining the 223 LF run with the ULTRA FLO® liner pipe using internal expanding bands with gaskets to connect the 25-foot pipe lengths. The manufacturer installed threaded grout plugs which allowed the contractor to place the grout evenly around the structure in stages. By using homogenous material, the ULTRA FLO® spiral rib liner pipe eliminates failures due to stress cracks, shrinkage cracks and air voids.

The result was a fully restored, structural solution that would extend the life of the existing culvert by over 100 service years with proper specification, sustainability from recycled material, strength, flexibility, versatility, and lightweight material.

ABOUT THE AUTHOR:

***Gaelyn Cunningham** is Senior Marketing Manager for Pipe Solutions at Contech Engineered Solutions and has worked with Contech for over 10 years. Cunningham can be reached at gaelyn.cunningham@conteches.com.*

BASARABA'S EXCAVATING AND DIRT WORKS:

Finding the Perfect Fit with Pipe Bursting in North Dakota

Brent Basaraba

By: TT Technologies

Brent Basaraba is a self-made man. A founding member of Basaraba's Excavating and Dirt Works, LLC., Wilton, ND, it's been hard work, perseverance and dedication that has taken him from the farm to the construction site to successful trenchless pipe bursting contractor. Now, he'd argue that much of his success is a result of his wife and managing partner Julie, his family and his deep rooted faith. And, after just a few minutes talking with him, it becomes apparent that that is equally true.

Basaraba said, "I grew up farming and I still do. I had an uncle that was an excavator. So, from the time I was 13 or 14 years old, and didn't have something to do on the on the farm, if I wanted to make some cash, I'd go help my uncle. Later in life I got a job at the local power plant and I thought that would be the dream job. But it didn't ever sit well with me. I'd been there about 6 years and one day my supervisor told me, 'Guys like you typically start their own company.' So, he planted that seed. About a year later I took out whatever retirement I had and bought my uncle out and started an excavating company. This was in about 2000, my first year in business with my wife."

Basaraba's Excavating and Dirt Works focused on basements and septic systems in the beginning. Later it was new developments, rural water and commercial projects, all open cut work. But after a decade and half of construction work, a hard look at the market and how the company was doing prompted Basaraba to reevaluate the path he was on.

He said, "I started looking where we were at and where things were going. We were doing things in 2016 for 2003

Basaraba's first bursting project for the City of Bismarck, ND included replacing 8,000 feet of 8-inch cast iron water main to 10-inch Certa-Lok® restrained joint PVC using a Grundoburst 800G static pipe bursting system

Over several pipe bursting projects, Basaraba has used restrained joint PVC, fusible PVC and poly. One the benefits of static pipe bursting is the method's ability to use a variety of product pipes

prices. That's where the market was at. But I wanted to get a head a little bit. So, I was at a crossroads. I tried selling some equipment at auctions, but I had a reserve on them so they wouldn't bring anywhere near what I wanted. And I prayed for wisdom and it was impressed on me to look into pipe bursting. I had heard of pipe bursting, but it was never something I wanted to do. But there was an opportunity there and through some effort, we secured a bid with a prime contractor. And there we were, we were bursting"

A phone call to pipe bursting specialist Dave Holcomb at trenchless equipment manufacturer TT Technologies, Aurora, Ill and Basaraba's Excavating and Dirt Works was on its way into the world of trenchless construction.

Pipe Bursting for Better or Worse

Basaraba started bursting with static pipe bursting equipment. He told one of his employees, Kacey Stein, to call TT Technologies and inquire about purchasing a pipe bursting system. Kacey did just that and spoke to Holcomb. According to Basaraba, Holcomb tried to dissuade Stein for purchasing the equipment. To which Stein, replied, "You don't know my boss!"

Basaraba laughed, "Well, I'm tenacious and I'm just going to make it work. I'd rather go down swinging then never to have tried!"

Holcomb explained the rest of the story. He said, "Since they were just starting out in pipe bursting, I suggested renting a machine first rather than buying a new one. Renting is a great option for contractors just getting into trenchless. A small investment up front can help them get into the industry. So, we gave him some rental numbers and they got the job. He picked up on the process really quickly and they've done a lot of bursting work. Brent is a really smart guy. He's become a success story by working hard, very hard. And I really admire him."

So, with a rented pipe bursting system, Basaraba and his crew began their first pipe bursting project with the City of Bismarck, ND.

First Burst, But Not the Last!

The city of Bismarck's water distribution system serves over 22,900 customers. Those customers receive their water through a 375-mile network of pipes. Water transmission and distribution pipes range in size from 6- to 42-inches in diameter. According to Basaraba, the city is about 3 years into a 10-year pipe bursting plan for the replacement of water mains.

Basaraba's first burst came as part of a street reconstruction project where the city just wanted to do overlays, so the trenchless bursting was a good choice. It included bursting and replacing 8,000 feet of 8-inch cast iron water main to 10-inch Certa-Lok® restrained joint PVC.

Holcomb said, "Static pipe bursting is very versatile. The fact that you can install fusible pipes, along with restrained joint pipe materials with this method makes it applicable to a wide range of projects. Special adapters and tooling facilitate

Basaraba crews try to complete 800 feet of bursting per week, start to finish. Since starting pipe bursting work, Basaraba's Excavating and Dirt Works now focuses almost exclusively on trenchless

those different product pipes. Pipes like restrained joint ductile iron pipe, restrained joint PVC pipe, and fPVC pipe, among others are viable with static bursting. Basaraba has installed several types of pipes over the last few years with their Grundoburst 800G."

Basaraba said, "We used Certa-Lok® restrained joint PVC on that first project. The second project we decided to go with fusible PVC. The pipe supplier did the initial fusing for us. But I decided to send a few guys, including my son Andy, to school for fusing. My son bought a fusing machine and now provides that service, at a competitive price, for us. This past year we tried poly. It was less money this year because of the issues with resin. But I really prefer to use fusible PVC."

Basaraba's crew was able complete the bursting project successfully, while still providing conventional open cut construction services. That has changed since then. Basaraba said, "We don't do any open cut work anymore. All we do is trenchless. I sold all my big excavators. It may not be as exciting as having a lot of big iron running around, but boy it sure pays the bills a lot better. It's nice to have a little money left at the end of the year instead of a lot of year left at the end of the money."

A Complete Trenchless Contractor

Basaraba's Excavating and Dirt Works employs 24 people at the height of the construction season, however, the company does have year round staff to do snow removal and water main repair in the winter. The contractor works with a local company to address jobsite safety. The company assists with items such as trench safety and equipment operation safety. Basaraba's crews also have weekly toolbox meetings to address more immediate safety practices like gloves, hard hats, hydration, working in the elements, etc.

Supplying accurate bids is critical to Basaraba's success. He said, "At the beginning of each project, after the job goes out for bid, that's when we walk it. We try to work out any issues that we might encounter. Restoration is bid in a lump sum, so we try to keep those costs under control. Otherwise we do everything except asphalt and concrete repair and tree replacement."

The construction season starts late and ends early in North Dakota. According to Basaraba, their season starts the minute the temporary water services don't freeze and lasts to the moment the temporary water starts to freeze. Temporary water services typically consist of a 2-inch main with ¾-inch services to the homes. For commercial properties, it is often a 2-inch service to ensure all the needs of the property are met.

Basaraba said, "We try to stay a week ahead on installing the temporary services. That's rather time consuming, while the bursting is typically the quickest part of the project. For bursting, it takes on average about 5 and a half hours to burst 500 feet. Our goal is to complete, start to finish, 800 feet per week, and that varies. But if we can get a couple blocks in a shot, 750 to 800 feet, we like to do that. A lot depends on where the connections are and the layout of the jobsite. Some weeks are better. It's in constant motion."

Basaraba is now expanding his trenchless offerings. After renting a pipe bursting system from TT Technologies for the first few years, Basaraba bought a Grundoburst 800G static pipe bursting system in 2020. Since then, the contractor has added a Grundopit pit launched directional drill that they use to replace lead service lines. And while the contractor continues push forward, he knows that he wouldn't have reached this point without support.

He said, "I have to give credit to my wife. When I'm out spending money and buying pipe bursting machines, she's the one trying to juggle the figures. My wife Julie and son Andy and his wife Lynn are involved in the company. I've taken them down a lot of different paths and had my fair share of failures and crash and burns. And when I said we were going to start pipe bursting, they were pretty skeptical. But I think we finally hit pretty close to a homerun! And I really do attribute this to God's leading provenance because I don't think we would have been here without it. I'm not a smart enough man to figure this all out without his guidance in my life."

Holcomb said, "That just goes to show what a quality person Brent Basaraba is. I think that says it all."

ABOUT TT TECHNOLOGIES:

TT TT TECHNOLOGIES

For more than 45 years, TT Technologies has been the worldwide leader in trenchless technology. Each year, more trenchless sewer, water, gas and electric rehabilitation and replacement projects are successfully completed with trenchless equipment from TT Technologies than any other. TT Technologies is the leader in trenchless!

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WEKO-SEAL Guarantees Long-Lasting Repairs to Any Type of Pipe

After a successful air test, a Miller Pipeline Technician screws in the test port plug (file photo)

Having the ability to call a contractor offering a full range of rehabilitation and replacement methods for pipeline systems utilizing multiple trenchless solutions can prove to be quite beneficial when something unexpected comes up during a construction project. It can speed up the process when unexpected circumstances arise.

In April 2021, Miller Pipeline completed a WEKO-SEAL internal joint seal installation for a long-time customer at Purdue University in West Lafayette, Indiana. Our WEKO-SEAL team repaired a 72-inch storm sewer that was damaged during construction. The repair consisted of one 71.75-inch extra-wide seal and one 72-inch double-wide seal. The double-wide seal was set in place first so that the extra-wide seal could overlap a portion of the double-wide. Four retaining bands were installed ensuring a successful repair that will last for years to come. This timely, efficient repair process and a long lasting relationship between the two firms led to another call when more damage was discovered during construction on a different part of campus.

Our personnel were called again when the general contractor was notified of damage to an existing 18-inch storm sewer line that was partially collapsing. Instead of completely excavating and replacing this line, our staff assessed the line and determined that cured in place pipe (CIPP) would be a good solution to this newfound problem. A Miller Pipeline CIPP crew came in to repair it with minimal downtime and disruption. It only took our crew one day to mobilize and install a new 'pipe within a pipe' replacing 115 feet of failing pipe.

Having the ability to provide multiple solutions, as well as give direction to other viable options performed by others, can speed up repairs on projects eliminating administrative and physical down time. This is a great trait of many great trenchless contractors whose goal is to lead owners to the best solution whether provided by the contractor

or others like them. This makes the trenchless industry such a rewarding industry to be a part of.

Contact Miller Pipeline's WEKO-SEAL team to see how they can help with any repairs on any type of pipe (including compound angles), carrying any product. Miller Pipeline can custom-create a WEKO-SEAL® to fit almost any pipe. The seal works with a wide variety of pipe shapes including round, elliptical, and rectangular, and it can fit practically any size you might encounter.

When a WEKO-SEAL® is installed, it lasts. The leak is sealed permanently and in nearly every case, further work will not be needed. Every WEKO-SEAL is backed with a guarantee that if Miller Pipeline installs it, it'll be done right, every time.

For more information, visit www.weko-seal.com.

A Miller Pipeline Technician applies hydraulic cement before installing a WEKO-SEAL (file photo)

MILLER PIPELINE
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ABOUT MILLER PIPELINE:

***Miller Pipeline** offers a full range of rehabilitation methods for wastewater pipeline systems, covering practically all methods of trenchless technologies, from pipe bursting and internal joint seals to trenchless options such as expanded-in-place PVC liner and cured-in-place pipe. A leader in building and maintaining America's infrastructure for over sixty years, Miller Pipeline is one of the nation's premier natural gas distribution, transmission pipeline and utility contractors.*

MULTI-SEGMENTAL FIBERGLASS LINING HISTORY AND FUTURE

Channeline Multi-Segmental 16-Foot Fiberglass Sewer Liner Installed in Detroit this Summer

CHANNELINE
Beyond the Ordinary

By: Andy Sherwin

Logistics

Back in 1984, when Channeline was incorporated to start manufacturing Structural Fiberglass, non-circular sewer liners, the impetus was towards the aging Egg shaped sewers of the UK and Europe. They were extremely successful in this market and as the Brand grew both locally and internationally, it became apparent that the technology being specified for ever larger sewers and culverts.

The dilemma became, how do you ship large-diameter custom manufactured egg-shaped pipe liners overseas when they do not fit into a standard shipping container?

The Solution we found to this logistical problem was a Tapered Tongue and Groove Jointing system. This system offered a way to break the geometrically complex pipe liners down into multiple component segments, while still maintaining structural integrity and load capacity when finally installed.

Channeline patented this proprietary Tapered Tongue and Groove Jointing system back in the 1990s and found that they were not only able to ship for increasingly large projects, but as they were able to secure the smaller pipe segments onto pallets, they could reduce the overall shipping cost of the lining system.

In many cases with very large structures, it is desirable for the pipe panels to be manufactured in two or more longitudinal sections. The panels are then bonded onsite using a structural adhesive above ground and a bell and spigot radial gasket or sealant joint. Once the segments are assembled, the Channeline GRP Structural Lining System provides the same structural performance of a Channeline manufactured single piece pipe with a stand-alone service life of 100 years.

As far as we are aware, this the largest Fiberglass sewer liner ever built to date.

Things have come a long way since the 90s and the Tapered Tongue and Groove Jointing system now has benefits, not only in reducing shipping costs, but for rehabilitation projects that have difficult access such as lining through manhole or maintenance chambers, where the same structural liner can be installed using fully trenchless methods. The Channeline Multi-segmental system has now been



Proprietary system offered a way to break the geometrically complex pipe liners down into multiple component segments to dramatically reduce shipping costs, while still maintaining structural integrity and load capacity

CHANNELINE
Beyond the Ordinary

CHANNELINE
GRP Structural Lining Systems

ANY SHAPE – ANY SIZE

Channeline International has been the premier Designer and Manufacturer of custom built, Fully Structural Rehabilitation Liners for Large Diameter Circular and Non-Circular Pipes and Culverts for nearly 4 decades. Rehabilitation of sewer and storm water pipelines with Channeline offers a , cost-effective and extremely durable solution with an expected service life of 100 years. The Channeline segments for each rehabilitation project are made to provide a precise fit to the size and shape required, thereby maximizing the cross-sectional area and optimizing the flow capacity. There really is no theoretical limit to the shape and size of Channeline panel that can be effectively manufactured. Channeline take pride in the workmanship during the Liner production and are fully Conformity for ISO 16611, WRc IGN 4-34-02 and ASTM – D3262 Fiberglass Reinforced Polymer Manufacturing Guidelines.

Applications:
- Sewer Main Pipelines
- Sewer Overflow Pipelines
- Sewer Interceptor Pipelines
- Sewer Inverts
- Storm Water Drains
- Seawater Cooling Pipelines
- Large Diameter Culverts and Tunnels
- Railway & Road Culverts
- Manhole Liners
- Multisegmental Liners

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Beyond the Ordinary

tested and approved for use by The Water Research Centre in the UK as well as many Cities in North America such as The City of Los Angeles, The City of Cleveland, City of Detroit, City of Toronto, City of Hamilton and The Regional Municipality of York to name a few.

Oakland-Macomb County, Detroit MI

A new milestone, and our most recent triumph, was the inclusion of the Multi-Segmental Liner in a Pilot Project for the North Interceptor, East Arm (NI-EA) PCI-4, Oakland-Macomb County in Detroit, which included the proposed use of 3 different lining system for a 17.5-foot diameter sewer pipe with a 16-foot ID Liner.

The NI-EA was constructed in six (6) contract sections over a period from 1969 until 1978. The NI-EA conveys sanitary and combined sewer flows from the Oakland and Macomb County communities serviced by the Oakland Macomb Interceptor Drain Drainage District (OMIDDD) north of the City of Detroit, with interconnections for the Conant – Mt. Elliott, Meldrum, and First-Hamilton Sewers that serve the north central portions of the City of Detroit. The interceptor has an approximate total length of 79,380 feet.

In April, 2015, NTH was engaged by DWSD to perform a confined space entry inspection of the portion of the NI-EA constructed under DWSD Contracts PCI-4, 18 and 19. The distress noted during the inspection of the sewer included loss of concrete liner thickness up to 6 inches in depth at locations along the crown of the sewer, exposed circumferential and horizontal reinforcing steel, scaling, and cracks. Based on the observed deterioration of the interceptor, recommendations were given to repair the first 1,500 feet of the NI-EA extending downstream from the NESPS.

In 2019, an NTH Engineering led team was engaged by OMIDDD to perform another confined space entry inspection of the portion of the NI-EA sections to provide an updated condition assessment of the existing interceptor. Using the NASSCO Pipeline Assessment Certification Program (PACP) inspection reports and photographs, NTH compared the 2019 observed conditions with historical inspection data presented in the January 8, 2016 NTH report. The overall condition of PCI-4 sewer reaches was considered fair to poor.

In June 2020, the Pilot Project was put out to bid for 1560 LF of the PCI-4 Interceptor and three technologies were specified as mandatory rehabilitation methods leaving the contractor to decide which of the three would manufacture the majority of the lining system. Low-bid contractor Marra Services of Cleveland Ohio chose Channeline to supply 1280LF of multi-segmental fiberglass liner with the proprietary Tapered Tongue and Groove Jointing system. Two remaining manufacturers were given 180LF each.

The liner is a 4 piece multi-segmental lining with a 16ft internal diameter. Having been designed using AWWA M45 Direct Bury calculations, the liner has a 3-inch wall thickness. Contractor Marra Services were flown over to Dubai to visit the factory and work with the manufacturing team to fine tune the assembly and installation process, and spent the week getting to know the Channeline Team. The liner is currently in production and first containers are due to arrive in Detroit in mid-August 2021. As far as we are aware, this the largest Fiberglass sewer liner ever built to date.

ABOUT THE AUTHOR:

Andy Sherwin *is the Technical Sales Director, North & South America, for Channeline International, a manufacturer of geometrically complex GRP Structural Lining Systems based in Dubai UAE.*

The Jason Foundation

THE JASON FOUNDATION

Get Involved in Helping At-Risk Youth

Suicide is the second leading cause of death for youth aged 10-24 in the United States.

Jason Flatt

The statistics are almost overwhelming. Suicide is the second leading cause of death for youth aged 10-24 in the United States, resulting in more than 125 deaths each week. Many people consider suicide an event that only happens "to someone else." That couldn't be further from the truth. Though it's easy to think of suicide as a tragedy that happens to other families, it's important to understand that suicide crosses all racial, economic, social, and ethnic lines.

For every suicide, roughly 147 people are directly or indirectly affected by that death. That means that every week, over 18,000 people are impacted by the suicide of a young person. In a year, almost a million people will be affected by youth suicide. Something must change. That's where the work of **The Jason Foundation** is so vital.

You may be wondering, *Who's Jason*? Yes, **The Jason Foundation** is named for a person.

In the summer of 1997, Jason Flatt was an average 16-year-old. He loved his friends. He loved sports, especially football. A solid B-student, he was active in his youth group and was always up for trying new things. All that changed on July 16 that summer. On that day, Jason transitioned from student to statistic when he took his life.

Jason's father, Clark Flatt, discovered his son at the family's home that afternoon when he failed to reach him by phone. In the almost 25 years since, Clark and the JFI staff have reached untold numbers of youth, educators, and parents through their work.

The Jason Foundation, Inc. (JFI) is a nationally recognized leader in youth and young adult suicide prevention and awareness. Its mission is to provide programs and resources for students, educators, parents, and communities to help recognize and assist young people who may be struggling with thoughts of suicide. JFI teaches the warning signs and risk factors of youth suicide so that everyone from peers to coaches to grandparents can get help for the young people in their lives who need it.

JFI refers to youth suicide as a "silent epidemic," because so few people talk about it. They don't discuss it among family members or with friends and colleagues. There's a belief that if someone talks about suicide, then it plants the idea in a young person's mind. The opposite is true. Talking about suicide doesn't give someone the thought that ending their life is something to consider.

A frank, open, and honest discussion with your child about your concerns shows them how supportive you are in helping them cope with their feelings. Though death is an uncomfortable subject for many people, it is important to be able to talk about it openly and honestly. There should be no fear in talking to young people about suicide. Approximately 80 percent of those considering suicide exhibit some sign of their intentions, either verbally or behaviorally. The following is a list of warning signs that a person contemplating suicide may present. It is, by no means, an exhaustive list.

- Talking about suicide
- Making statements about feeling hopeless, helpless, or worthless
- Deepening depression
- Preoccupation with death
- Taking unnecessary risks or exhibiting self-destructive behavior
- Out-of-character behavior
- Loss of interest in the things one cares about
- Making final arrangements
- Giving away prized possessions

Everyone needs to be aware of the warning signs associated with suicidal thoughts and know how to respond if someone's behavior causes concern.

JFI offers a variety of online training modules for anyone who wishes to utilize them. Staff will also visit schools, first responders, and a number of other community groups (live or via online streaming) to present information. The Jason Foundation has never charged any school, family, or community for the use of its programs or materials. This ensures that lack of funding is never a determining factor of who can obtain the information that could possibly save a life.

Visit www.jasonfoundation.com for programs and resources.

PROMOTING TRENCHLESS TECHNOLOGY IN THE MIDWEST!

MSTT Seminar in Milwaukee Sign of Future Success

The Trenchless Technology seminars hosted by MSTT in locations across the Midwest have been a mainstay of trenchless technology outreach and education efforts across the region for nearly two decades.

Since 2003, MSTT has now held a total of 38 seminars in 14 different cities across the Chapter's nine state area. These seminars have engaged over 1950 underground infrastructure professionals over this period, facilitating meaningful direct networking between industry and owner groups. As part of the MSTT mandate to "promote Trenchless Technology through education for the public benefit", the seminar programs are designed to inform public officials, engineers, utility company personnel, designers, and contractors involved with the construction, rehabilitation, and management of underground infrastructure assets, in the Midwestern states. They are great venues for educating decision-makers on the many social and economic benefits of using trenchless technology in their infrastructure renewal and new construction programs.

As an example of the industry/organization collaborations fostered by MSTT seminars, a very successful two-day Trenchless Technology seminar was hosted June 26 – 27, 2019 at the Miller Pipeline Training Facility in Indianapolis IN. MSTT

Jeff Boschert, P.E. President National Clay Pipe Institute, and Past-President MSTT, outlines Wisconsin case studies on the Pilot Tube Method and Guided Auger Boring

Kevin Lyons, P.E., Engineering Design Manager, Milwaukee Metropolitan Sewerage District, delivered an excellent presentation on the Trenchless Technology programs in his city

Up close and personal networking are an integral feature of the MSTT seminars

The seminar featured industry exhibits with a broad range of trenchless technology products and services

"Next day, March 12, 2020, after the Kansas City seminar, everything had changed."

- Leonard Ingram, PWAM, MSTT Executive Director."

also conducted a very well-attended single-day seminar December 3, 2019 in Omaha NE, which was held in conjunction with the Rocky Mountain NASTT Chapter (RMNASTT) and co-hosted by the ASCE Nebraska section and the APWA Nebraska Chapter.

As a hopeful sign for 2022, MSTT recently held a very successful well-attended one-day seminar August 25, 2021 at the Hilton Milwaukee City Center Hotel. Held in conjunction with the APWA Wisconsin Chapter it featured Kevin Lyons, P.E., Engineering Design Manager, Milwaukee Metropolitan Sewerage District and his presentation "Trenchless Technology at Milwaukee Metropolitan Sewerage District". There were ten other presentations by industry professionals on a wide range of trenchless technology topics, along with exhibits from 15 industry suppliers.

There is renewed optimism as 2022 gets underway that MSTT will be able to resume these very effective in person **Trenchless Technology, SSES and Buried Asset Management Seminars** in locations across the Midwest.

Special thanks to MSTT seminar exhibitors, sponsors, presenters and attendees for all our seminars. **THANKS FOR YOUR ONGOING SUPPORT!!!**

MSTT Trenchless Technology seminars are excellent networking and educational opportunities

For information dates and locations of future MSTT Trenchless Technology, SSES and Buried Asset Management seminars and virtual webinars planned for the Midwest, visit:

www.mstt.org

MILWAUKEE SEMINAR AUGUST 25, 2021: MSTT – APWA WISCONSIN

GUEST PRESENTATION

"Trenchless Technology at Milwaukee Metropolitan Sewerage District"
Mr. Kevin Lyons, P.E., Engineering Design Manager, Milwaukee Metropolitan Sewerage District, Milwaukee, WI

PRESENTATIONS

Welcome to the Trenchless Technology Seminar,
Leonard Ingram, PWAM, MSTT Executive Director

Buried Asset Management Institute – International (BAMI-I) & Certification of Training in Asset Management (CTAM) Program,
Tom Iseley, Ph.D., P.E., Dist. M. ASCE, PWAM, Chair, BAMI-I Board of Directors

Pipe Bursting,
Joe Abell, TT Technologies, Inc.

Infiltration, Destruction and the Holistic Approach to Salvation,
John Manijak, Michels

Multi Sensor Inspection,
Ed Diggs, Pipeline Inspection Partners Corp. PIPC (Purveyor of Cues High Technologies)

Introduction to PVC Liners,
Jimmy Stewart, Mechanical Jobbers Marketing

Pilot Tube Method of Guided Boring and Case Studies in Wisconsin,
Jeff Boschert, P.E., National Clay Pipe Institute

Internal Joint Seals,
Jeremy Keininger, Miller Pipeline Corp.

Why Asset Management & Data Integration,
Clifford Woodward, SewperCoat

Next Generation Trenchless Technology,
Nate Hrabosky, Hammerhead Trenchless Equipment

Lead Service Pipe Remediation,
Grant Whittle, NuFlow

Pipeline Rehabilitation,
Ali Alavi, Stantec

Geospray Geopolymer Mortar System for Structural Repair / Rehabilitation of Sewer and Storm,
David E. Keaffaber, P.E.

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