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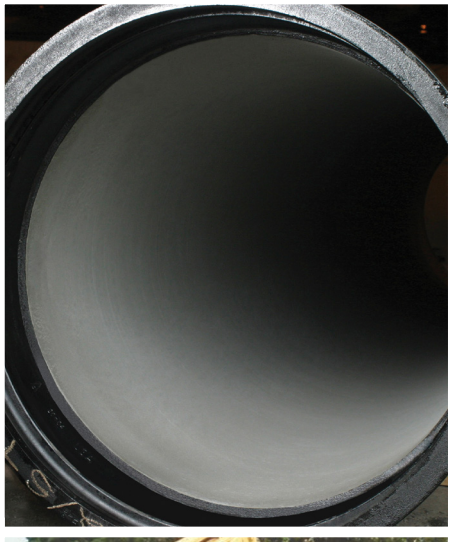
Trenchless TECHNOLOGY

SPECIAL REPORT

TRENCHLESS PIPE MATERIALS



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SPECIAL REPORT
STORMWATER · AUGUST 2024

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PROMOTING TECHNOLOGY IN THE UTILITY CONSTRUCTION INDUSTRY

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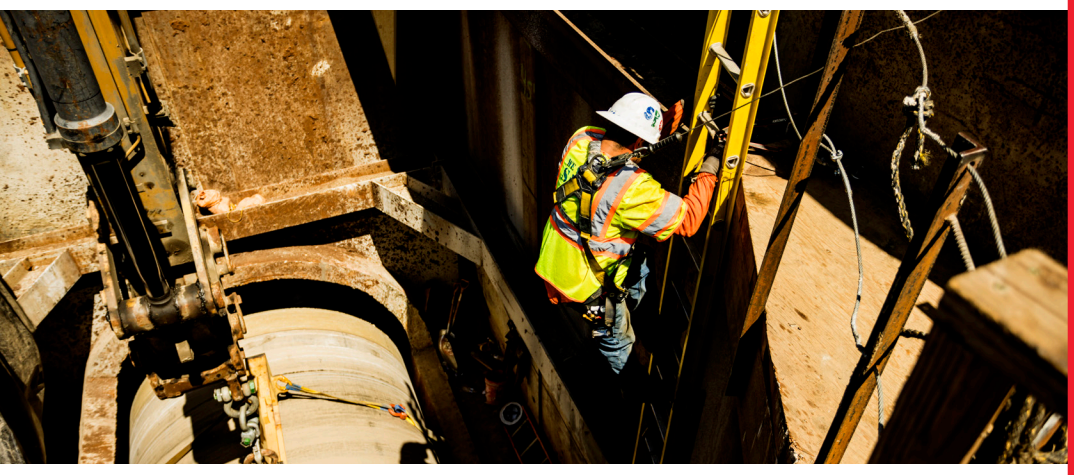
FROM THE EDITOR

NOT ALL PIPE IS THE SAME!

By Sharon M. Bueno



Product pipe. The pipe is the backbone of any trenchless project, acting as the essential pathway for utilities—whether it's gas, water, wastewater, electric, or telecom. Understanding the advantages and limitations of each type of pipe on the market is crucial for project success.

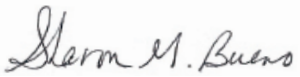
But is one pipe the same as another? Thinking that way shows a knowledge gap, and we're here to ensure our readers are well-informed. That's why we've put together this Pipe Selection Guide Special Report to support your search for the right pipe.

Concrete, concrete pressure pipe, ductile iron, fiberglass-reinforced, HDPE, polymer concrete, PVC, steel, vitrified clay — these materials are all commonly chosen for today's trenchless projects. Selecting the right pipe for your project, whether it involves sewer, water, gas, or fiber optic/telecom lines, is a fundamental part of the design process. But how do you determine which pipe will best serve your system's needs?

Enter the 2024 *Trenchless Technology* Pipe Selection Guide. To help our readers, we reached out to pipe associations and manufacturers representing the nine primary types of pipes used in trenchless work, gathering insights on the unique benefits of each option. While we've shared similar guides in past years, most recently in 2022, the industry has evolved. Our updated guide offers fresh perspectives and highlights changes in these materials.

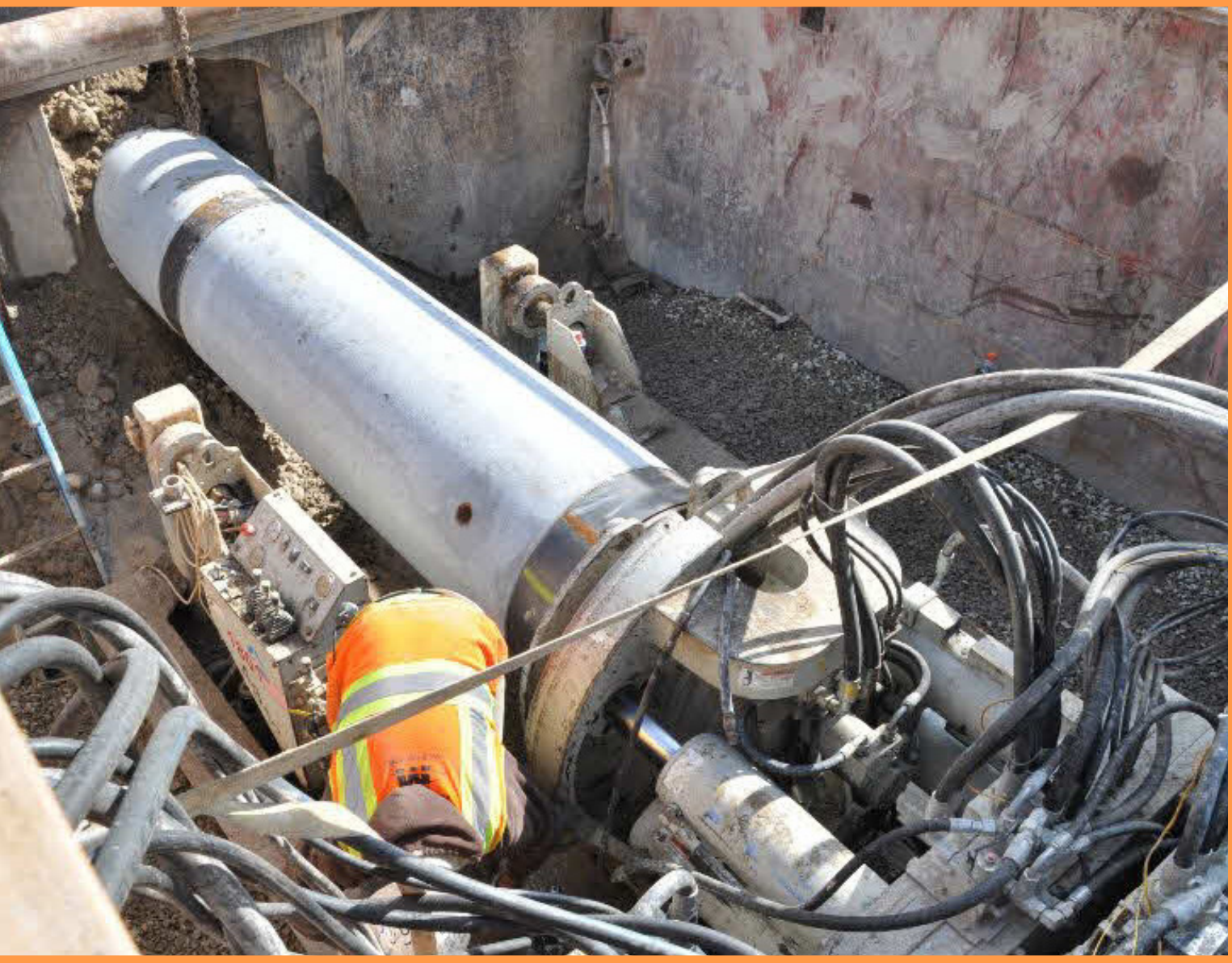
Consider this Special Report your starting point. It's designed to give you an overview of the different pipes available, but for detailed specifications, consult the manufacturer, pipe association, or your project engineer. All information here is provided by these experts, with the hope of enhancing your understanding of product pipe selection.

We are here to help and it is our hope that this Special Report does just that.



Sharon M. Bueno
Editor, *Trenchless Technology*

PRECAST CONCRETE PIPE



TRENCHLESS APPLICATIONS:

Concrete pipe is ideal for new installations, or rehabilitation efforts utilizing jacking and microtunneling, and other instances where high compressive strength is needed for pushing a pipeline into its final location.

BEST SUITED FOR:

Buried precast concrete products are well suited for applications where high compressive forces are needed for the process of installation, such as jacking and microtunneling. Shapes, such as circular, elliptical, arch and rectangular box sections allow for a variety of choices to accommodate physical obstructions that may limit space.

NOT WELL SUITED FOR:

Concrete pipe is not well suited for applications having high internal pressure.

HOW IS IT DELIVERED:

Precast concrete pipe and box culverts are delivered in precast units that are ready for installation.

DESIGN LIFE:

Concrete pipe has a proven service life of more than 100 years.

HOW IS IT JOINED:

Precast concrete pipe and box units can be supplied with soil resistant, silt resistant, and leak resistant joints. For microtunneling installations, gasketed joints are typically used, along with a large bearing area in the joint for jacking forces.

AVAILABLE DIAMETERS:

Circular reinforced concrete pipe is available from 12 in. to 144 in. in diameter. Elliptical and arch shapes are available for locations with limited vertical or horizontal clearance. These shapes have sizes equivalent to 132 in. diameter circular pipe and less. Additionally, square and rectangular shapes are available in standard dimensions up to 12 ft. by 12 ft., with larger nonstandard sizes available.

LATEST DEVELOPMENT OVER THE LAST FIVE YEARS:

Advancements in the use of cementitious and non-cementitious materials and admixtures continue to provide greater strength, longer durability, and more sustainable products. Additionally, manufacturing equipment and processes continue to evolve and improve product quality. In the last five years ASTM Standard C1885 has been developed for the manufacture of concrete jacking pipe, and ASTM C1941 has been developed for the manufacture of precast concrete box culverts for jacking.

WHAT IS NOTABLE ABOUT YOUR PIPE:

Precast concrete pipe can be supplied in a variety of sizes, shapes, and strengths. You can design the pipe for the installation conditions, instead of designing the installation conditions for the pipe. When precast concrete pipe is specified and installed, there is less anxiety about conforming to product limitations and greater confidence in performing to expectations. Its resilience to both the installation and final loading conditions ensures performance is sustained for many years to come.

Source: American Concrete Pipe Association
Web: www.concretepipe.org

DUCTILE IRON PIPE

APPLICABLE STANDARDS:

- ANSI/AWWA C150/A21.50 – Thickness Design of Ductile-Iron Pipe
- ANSI/AWWA C151/A21.51 – Ductile-Iron Pipe, Centrifugally Cast
- ANSI/AWWA C111/A21.11 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- ANSI/AWWA C104/A21.4 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
- ASTM A746 – Ductile Iron Gravity Sewer Pipe
- ASTM A716 – Ductile Iron Culvert Pipe
- ANSI/AWWA C105/A21.5 – Polyethylene Encasement for Ductile-Iron Pipe Systems
- ANSI/AWWA C110/A21.10 – Ductile-Iron and Gray-Iron Fittings
- ANSI/AWWA C153/A21.53 – Ductile-Iron Compact Fittings
- ANSI/AWWA C600 – Installation of Ductile-Iron Mains and Their Appurtenances

TRENCHLESS APPLICATIONS:

Horizontal directional drilling, pipe bursting, microtunneling, and pipe jacking

BEST SUITED FOR:

Water and wastewater pipeline installations, both gravity and pressure applications, and any installations that require a robust/strong pipe.

NOT WELL SUITED FOR:

There really isn't a water or wastewater pipe project where ductile iron pipe would be ill suited.

HOW IS IT JOINED:

For underground service, gasketed push-on joints are normally specified. In HDD applications, a restrained joint is needed – check with pipe manufacturers for recommendations. Other proprietary compression ring gasketed joints that facilitate trenchless applications. The push-on joint is deflectable (as much as 5 degrees) to facilitate HDD applications and routing the pipeline with minimal fittings.

AVAILABLE DIAMETERS:

3-in.diameter through 64-in. diameter (3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, 30, 36, 42, 54, 60, and 64-in. diameters)

LATEST DEVELOPMENT OVER THE LAST FIVE YEARS:

Introduction of seismic joints for use where permanent ground deformation events are anticipated.

HOW IS IT DELIVERED:

Normally, 18- or 20-ft lengths. The standard push-on joint can also be cut in the field if shorter lengths are needed.

DESIGN LIFE:

Indefinite when properly designed and installed.

WHAT IS NOTABLE ABOUT YOUR PIPE:

Successful trenchless installations have firmly established ductile iron pipe as a viable, and in many instances superior, pipe option. The advantages of using ductile iron pipe for trenchless installations include:

1. Standard pressure capabilities up to 350 psi (greater upon special request)
2. Great material strength for handling pull-back, column, and external dead and live loading
3. Better distribution of thrust or pulling forces around the bell and barrel
4. Greater allowable pulling forces than other pipe options
5. Generous allowable joint deflections
6. Quick, easy joint assembly
7. Cartridge installation option for limited easements or ROW for HDD installations.
8. Can be located from surface with commonly used locators
9. Performance capabilities are not impacted by elevated temperatures
10. Demonstrated to withstand temperatures generated in wildfire conditions
11. Material strength that does not creep or decrease with time
12. Pipe wall impermeable to volatile hydrocarbons, minimizing the potential of water system contamination in the present or future
13. A very strong pipe able to handle residual bending stresses that could adversely affect future serviceability.
14. No significant "recoil" and minimal pipe movement due to thermal expansion.
15. Eliminates potential for shearing of tapped lateral outlets due to thermal expansion and contraction

FINAL PARAGRAPH:

With the increasing demand for water and wastewater infrastructure and a movement to reduce the social-economic impact on rate payers that is often associated with open-cut construction, trenchless installation will certainly play an increasing role. For these installations, public works personnel and contractors have the option of installing superior ductile iron pipe.

Source: Ductile Iron Pipe Research Association
Web: www.dipra.com

CONCRETE PRESSURE PIPE

TRENCHLESS APPLICATIONS:

Jacking and microtunneling operation that requires high compressive strength pipe and watertight joints. In North America, reinforced concrete pipe (RCP) has been installed by jacking for nearly 100 years and by microtunneling since 1986. PCCP has also been widely used as the carrier pipe for traditional two-pass tunnel installations.

BEST SUITED FOR:

Concrete pressure pipe is best suited for a wide range of trenchless applications including, but not limited to, gravity, storm and sanitary, outfalls, force mains and transmission mains casing pipe and/or carrier pipe, etc. Reinforced concrete pipe – non-cylinder type (AWWA C302) low pressure pipe and reinforced concrete cylinder pipe (AWWA C300) pressure pipe can be used as both the casing and carrier pipe in a single pass operation. Prestressed concrete cylinder pipe (AWWA C301) can be used as the carrier pipe in a two-pass installation.

NOT WELL SUITED FOR:

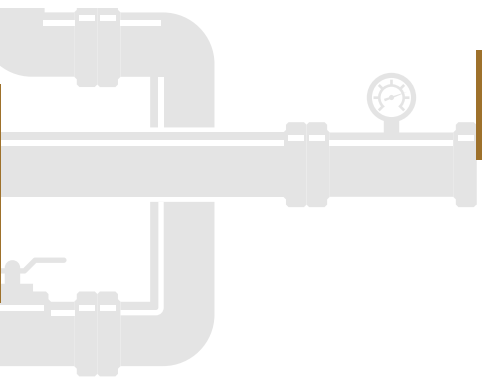
Thicker pipe wall of C300 and C302 pipe may not be suited with small boring machine diameters, although many MTBMs can be used. C301 pipe is not suitable for direct jacking.

HOW IS IT DELIVERED:

Concrete pressure pipe is delivered by truck in 10-ft (3m) to 20-ft (6m) lengths that are ready for installation.

DESIGN LIFE:

It is generally agreed that CPP has a service life of 75 to 105 years.



HOW IS IT JOINED:

Reinforced concrete cylinder pipe (C300) is provided with steel bell and spigot joints, sealed with a confined rubber gasket. C300 pipe is suitable for high pressure applications. The joints can be welded to provide thrust restraint. Additional sand resistant exterior bells can also be provided. Reinforced concrete non-cylinder pipe (C302) is typically provided for low-pressure applications, and commonly have a steel bell and spigot or a steel bell and concrete spigot, also sealed with a confined rubber gasket. Prestressed concrete cylinder pipe (C301) also uses steel bel land spigot joints sealed with a confined rubber gasket like C300 pipe and can have welded joints for thrust restraint. C301 also has mechanically restrained joints readily available that make for fast installation. All pipe joints are available with double gasket air testable Joints and can be deflected for long radius curved drives.

AVAILABLE DIAMETERS:

C300, C301 and C302 pipe is generally available in diameters from 24-in. to 144-in. (60-0mm to 3,600-mm).

LATEST DEVELOPMENT OVER THE LAST FIVE YEARS:

Enhanced C300 design to allow for single pass water main or other high-pressure applications. Continuous improvement of AWWA standards ensure the high-quality of concrete pressure pipe.

WHAT IS NOTABLE ABOUT YOUR PIPE:

All ACPPA plants are audited annually by Lloyds Register Quality Assurance (LRQA) to assure that all pipe is manufactured in strict compliance with both the AWWA standards and project specifications. C300 and C302 pipe is "wet cast" and cured in its forms, providing a dense smooth-wall pipe, round on the barrel and square on the ends, with a dimensional accuracy such that every pipe is essentially a carbon copy of the others. C301 pipe is made by means of a spun concrete core that creates a smooth consistent finish from one end of the pipe oto the other and a dense mortar coating on the outside. Naturally resistant to corrosion and can accommodate a wide variety of applications. Since pipe is engineered for the project application, design considerations can often be made to accommodate unique project requirements and site conditions.

Source: American Concrete Pressure Pipe Association
Web: www.acppa.org

FIBERGLASS REINFORCED PIPE

TRENCHLESS APPLICATIONS:

Pressure and gravity sliplining, microtunneling/jacking, tunnel lining casings, pipe bursting, directional drilling.

BEST SUITED FOR:

Potable water transmission, force main or gravity sewer systems and all applications where there is a corrosive carrier or external environment.

NOT WELL SUITED FOR:

Gas transmission and other hydrocarbon transmission Lines.

HOW IS IT JOINED:

Unless otherwise specified, the pipe shall be field connected with fiberglass sleeve couplings that utilize elastomeric sealing gaskets to maintain joint water tightness. The joints must meet the performance requirements of ASTM D4161. Tie-ins, when needed, may utilize gasket-sealed mechanical couplings.

AVAILABLE DIAMETERS:

The pipe is available from 18 to 158 in. diameters.

HOW IS IT DELIVERED:

The typical delivered length is 20 ft; however, both short sections (e.g. 5 ft and 10 ft) and longer lengths of up to 40 ft are available to minimize the number of joints.

DESIGN LIFE:

In excess of 150 years.

APPLICABLE STANDARDS:

AWWA C950 for fiberglass pressure pipe and ASTM D3754 for fiberglass sewer and industrial pressure pipe. ASTM D3262 for gravity systems. ASTM D4161 coupling joints. ASTM D2412 External Loading Characteristics by Parallel-Plate loading. Fiberglass pipe can be utilized in a wide range of service conditions including extreme cold, which does not affect the material and operating temperatures up to 180 F, with pressures up to 500 psi. Each pipe is designed for soil burden, external water pressure and live loading conditions. The pipe is easily repairable and modify in the field should conditions warrant. Hydraulic analysis shows superb flow characteristics, Manning's of n=0.009 and Hazen Williams of C=155. In addition, the pipe surface is extremely abrasion resistant.

LATEST DEVELOPMENT OVER THE LAST FIVE YEARS:

In the United States, increased application of sliplining and pipe jacking that enables public utilities to maintain their sewage system operation requires a corrosion resistant pipe that can accomplish high push-loading. In addition, there is an increased application of microtunneling, pipe bursting and directional drilling where fiberglass pipe and manway manufacturers are providing a corrosion resistant alternative to traditional pipe materials. The Fiberglass Tank & Pipe Institute represents manufacturers of pipe and manways such as NOV Fiber Glass Systems and Hobas Pipe USA.

WHAT IS NOTABLE ABOUT YOUR PIPE:

Fiberglass pipe and manways are gaining in market presence due to their many benefits. When leak-free joints, inherent corrosion resistance, superior hydraulic characteristics and long-life service are taken into account, fiberglass is a clear winner. There are cost-savings that accrue over the lifetime of the product due to lower maintenance and extended life expectancy over traditional materials. However, cost-savings begin at installation with reduced onsite handling costs (i.e., high strength/weight ratio material) and reduced labor and installation time (e.g. longer pipe with fewer joints/manways). Fiberglass pipe is an engineered product that may be custom manufactured with fiberglass manways and fittings to meet the most difficult jobsite applications," says Sully Curran P.E., executive director, Fiberglass Tank & Pipe Institute

Source: Fiberglass Tank & Pipe Institute
Web: www.fiberglasstankandpipe.com

HIGH-DENSITY POLYETHENE (HDPE)

TRENCHLESS APPLICATIONS:

Horizontal directional drilling (HDD), static and pneumatic pipe bursting, sliplining and compression-fit using solid wall HDPE (PE4710) piping systems.

BEST SUITED FOR:

Potable water (service, distribution, and transmission), reclaimed water, force main, gravity, and storm sewer, industrial, Factory Mutual fire water protection, methane/leachate collection, nuclear, conduit (electrical and communication) and natural gas distribution. This summary will focus on HDPE solid wall for water and sewer.

NOT WELL SUITED FOR:

Refer to applicable standards and requirements. Also, pressure applications with annual average temperature exceeding 140 F and pressure class exceeding 335 psi.

Applicable Standards: • ANSI/AWWA C901, ANSI/AWWA C906 – municipal
• ASTM D3035, F714 Transmission and Industrial
• Factory Mutual FM 1613 Fire Water Protection
• Joining: ASTM: F2620, F1055, F1290
• Installation: ANSI/AWWA M55; Plastics Pipe Institute Handbook of PE Pipe, ASTM D2321, D2774, F585, F1962, F2164, F2206, F3190
• NSF-14 and NSF-61

HOW IS IT JOINED:

Butt-fusion and electrofusion are preferred methods for joining HDPE per ASTM F2620, MAB-1, and MAB-2; both joining systems create monolithic and self-restrained joints. However, HDPE can also be joined by mechanical fittings that are properly designed for HDPE pipe.

AVAILABLE DIAMETERS:

¾ in. to 65 in. per ASTM and AWWA Standards

HOW IS IT DELIVERED:

HDPE pipe is produced in straight lengths up to 50 ft and coiled in diameters up to
6 in. Depending on pipe size, coiled length can exceed 1,000 ft.

DESIGN LIFE:

Properly designed, installed, operated HDPE piping systems have a design life exceeding 100 years based on internal pressure, cyclic fatigue, and degradation/oxidation.

LATEST DEVELOPMENT OVER THE LAST FIVE YEARS:

High performance PE4710 is the 4th has been implemented in United States and Canadian standard, manuals and software. New documents and resources were published (or updated) as listed below:

Documents

- AWWA C901, C906 and M55 (2020/2021)
- ASTM F1962 on HDD (2022)
- Seismic Response of HDPE Laterals (2021)
- MAB-1 on electrofusion (2022)
- MAB-3 Model Specifications (2024)
- MAB-4 on Repairs (2019)
- MAB-5 on pipe bursting (2019)
- MAB-6 on inspection (2020)
- MAB-7 on mini-HDD (2020)
- MAB-8 on cold weather fusion (2022)
- MAB-9 on HDPE design for seismic hazard: Lateral Spread (2023)
- MAB-11 Model Specs for Installation of HDPE by Horizontal Directional Drilling (2024)

Software:

- PPIPACE for water hammer and fatigue design life forecast
- PPIBoreaid for horizontal directional drilling
- HDPEapp for multiple design and installation calculations

WHAT IS NOTABLE ABOUT YOUR PIPE:

Properly designed and installed HDPE piping systems have the lowest failure rate, zero allowable leakage for heat fused joints, fully restrained joints, lowest initial and life cycle costs, inherent corrosion resistance, longest design life, longest fatigue life and is the preferred material for trenchless installations. Also, due to high ductility, HDPE water piping systems had zero failures in the last five earthquakes in Japan, Chile and New Zealand. Also provides system integrity during soil movement events such as drought and flood. Per AWWA C906-21 standard, PE4710 pressure class includes a safety factor greater than 2 for the allowed operating stress and for surge pressures (recurring and occasional). Per AWWA C906-21 standard, matching the ID of other pipe materials to the ID of HDPE for flow and PC will yield incorrect results. Use PPIPACE.com to evaluate flow capacity and PC of HDPE to other materials.

Source: Plastics Pipe Institute
Web: www.plasticpipe.org/MABpubs

TRENCHLESS PIPE MATERIALS:
HDPE'S LEAD IN MODERN INFRASTRUCTURE

Tucson Water Sahuarita Supply Line rehabilitated using 32" HDPE DR 21 pipe, installed via sliplining trenchless method.

Trenchless Solutions for Modern Infrastructure

Trenchless technology has transformed the way we install and rehabilitate pipelines, providing more efficient, less disruptive alternatives to traditional methods. But what makes trenchless piping projects successful? At the center of this innovation is the selection of material that performs under various operational conditions. High-density polyethylene (HDPE) stands out for its versatility, durability, and sustainability, making it the material of choice for many trenchless applications.

What Is Trenchless Technology?

Trenchless technology refers to methods used to install or repair pipelines with minimal excavation. Techniques like horizontal directional drilling (HDD), pipe bursting, and sliplining allow contractors to install piping systems without the need for large-scale digging. This reduces the impact on surrounding infrastructure and cuts costs by minimizing labor, time, and surface restoration expenses.

In densely populated areas, where disruption can be costly and time-consuming, trenchless technology is increasingly favored. It has proven to be a sustainable and cost-effective solution for modern infrastructure piping projects, making material selection more critical than ever.

Miami-Dade Sewer Force Main rehabilitated with more than 4,000 feet of 54" HDPE pipe, installed using Horizontal Directional Drilling.

Why HDPE Leads the Pack

HDPE is the favored material for trenchless installations due to its unique properties. Its flexibility, corrosion resistance, and ability to be fused into leak-free systems make it well-suited for trenchless methods in urban areas, environmentally sensitive zones, and challenging terrains. These methods include horizontal directional drilling (HDD), slip lining, and pipe bursting, where HDPE's adaptability ensures long-lasting and efficient results.

- **Flexibility and Durability:** HDPE pipes can bend to accommodate the contours of the installation site, reducing the need for fittings. This flexibility is valuable in trenchless methods like HDD, where pipelines must follow a curved path underground. Additionally, HDPE's resistance to cracking and fatigue ensures a lifespan of more than 100 years.
- **Corrosion Resistance:** Unlike ductile iron or steel, which can corrode over time, HDPE remains resistant to chemical exposure that often deteriorates other materials. This is particularly important in rehabilitating legacy pipelines, where corrosion has already caused significant damage.
- **Leak-Free Joints:** One of the standout features of HDPE is its ability to be heat-fused, creating a seamless, monolithic system. This eliminates potential weak points at the joints, common in materials like PVC or steel that rely on mechanical couplings.

Other Trenchless Materials: A Brief Comparison

While HDPE takes the spotlight, there are other materials used in trenchless applications—though they often don't offer the same comprehensive benefits as HDPE.

- **PVC:** A cost-effective option for some trenchless installations, PVC is lightweight, making it easy to handle. However, it lacks the flexibility of HDPE and requires additional fittings, which can introduce potential leak points.
- **Ductile Iron:** Known for its strength, ductile iron is used in some trenchless installations. However, it is prone to corrosion, especially in harsh environments, and its heavier weight can complicate installation compared to the lighter, more flexible HDPE.
- **Steel:** Steel is still used for trenchless applications that demand high pressure tolerance. But like ductile iron, it is vulnerable to corrosion and requires protective coatings, increasing long-term maintenance costs.

ISCO's Snap-Tite HDPE relining system restores culverts by easily slipping inside deteriorating pipes, extending their service life with minimal disruption.

While these materials have specific use cases, HDPE's combination of flexibility, durability, and long-term cost savings makes it the top choice for most trenchless installations.

HDPE in Trenchless Rehabilitation

HDPE's versatility extends beyond new installations. It plays a crucial role in trenchless rehabilitation techniques such as sliplining and pipe bursting. Sliplining involves pulling a new HDPE pipe into the existing, deteriorating pipeline, sealing the annular space, and creating a new, durable line that resists both internal and external corrosion. A notable product in this space is Snap-Tite—widely used for culvert rehabilitation. Snap-Tite's HDPE liner system is engineered to fit inside aging culverts, restoring structural integrity and extending the service life of the pipeline, all while minimizing disruption to the surrounding environment. The ease of installation and long-term benefits of Snap-Tite make it a reliable solution for culvert rehabilitation projects.

Pipe bursting, another method where HDPE excels, involves fracturing the existing pipe while pulling a new HDPE pipe into place. HDPE's strength allows it to expand to fit the void left by the burst pipe, making it a superior material for replacing failing systems.

A Trenchless Future with HDPE

As the need for reliable infrastructure grows, trenchless technology will only become more critical. HDPE stands as the material poised to meet these demands, offering long-term solutions with minimal environmental impact.

While materials like PVC, ductile iron, and steel have their roles in the trenchless world, HDPE remains the best option for projects that prioritize longevity, flexibility, and overall performance.

If you're considering a trenchless installation or rehabilitation project, HDPE offers the perfect balance of reliability and cost-efficiency. Its track record of success and extensive use across various piping applications makes it the clear choice for modern infrastructure needs.

ISCO's experienced team of experts can help guide you through the process of selecting the best material for your trenchless application. Contact us today for a consultation or to learn more about our range of trenchless piping solutions.

ISCO®

Your go-to resource for HDPE products and expertise.

Whatever your project, industry or application, ISCO has the solution in high-density polyethylene (HDPE) piping products, services and fusion equipment.

Call to speak with an expert
(800) 345-ISCO

Visit us online to learn more
isco-pipe.com

POLYMER CONCRETE

TRENCHLESS APPLICATIONS:

Microtunneling, pipe jacking, one-pass tunnel segments. Structures and shafts for tunnel construction.

BEST SUITED FOR:

For sanitary sewer or industrial sewer service where conditions require corrosion protection.

NOT WELL SUITED FOR

Currently, polymer concrete pipe is not designed for or approved for pressure of potable water applications.

HOW IS IT DELIVERED:

Pipe is typically delivered in 8- or 10-ft lengths by means of truck, closed container for ocean freight or rail. For pilot tube installation methods, 1 m lengths are available.

DESIGN LIFE:

Polymer concrete pipe has a projected 100-year plus service life.

HOW IS IT JOINED:

Standard joint for jacking installations incorporates a double spigot joint joined by a flush compression fit fiberglass or stainless steel collar. The collar mates against the gasket firmly joined to the pipe wall. The joint meets the requirements of several ASTM standards.

AVAILABLE DIAMETERS:

Polymer concrete pipe is available in diameters ranging from 8 to 144 in.

APPLICABLE STANDARDS:

ASTM D6783. Other standards including ASTM C-76 and AWWA design methods can be used.

LATEST DEVELOPMENT OVER THE LAST FIVE YEARS:

Production capacity of polymer concrete pipe and products has increased significantly in recent years. Product availability in several geographic locations will translate into freight savings for owners.

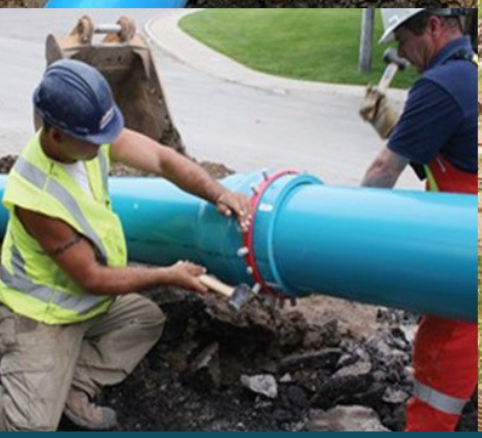
WHAT IS NOTABLE ABOUT YOUR PIPE:

"In choosing a pipe material, owners have found that polymer concrete pipe, with its unique physical properties, combines the best attributes of the leading pipe materials- inherent corrosion resistance of FRP pipe along with the rigid properties of reinforced concrete pipe. Years back when we first introduced the reinforced polymer concrete pipe to the market we often described polymer concrete pipe as a hybrid to those unfamiliar with the product. Nowadays, everyone is much more familiar with polymer concrete and our product availability has increased significantly even in the last couple years with added production capacity in North America," Mike Olson, Interpipe Polymer/PolymerCrete.

Source: Interpipe Polymer/PolymerCrete
Web: polymerpipe.com

POLYVINYL CHLORIDE (PVC)




TRENCHLESS APPLICATIONS:

Horizontal directional drilling, pipe bursting, segmental sliplining, and close-fit pipe lining.

BEST SUITED FOR:

Potable water, reclaimed water, sewer force main gravity sanitary sewer, and storm sewer pipe and fittings.

NOT WELL SUITED FOR

Applications where fluid temperatures consistently exceed 140 F or high-pressure applications above 305 psi working pressure.

HOW IS IT DELIVERED:

Standard lengths are 20 or 22 ft for pressure pipe and 14 to 22 ft for sewer pipe. Alternative lengths are available on a limited basis.

DESIGN LIFE:

Multiple studies have confirmed that PVC pipe lasts in excess of 100 years.

AVAILABLE DIAMETERS:

Gasketed PVC pressure pipe is available in sizes from 4 to 60 in. Gasketed PVC gravity sewer pipe is available from 3 to 60 in.

HOW IS IT JOINED:

Trenchless applications can utilize spline-locked gasketed couplers or joints, bell-and-spigot joints locked together with either an internal gripper ring assembly or a ring-and-pin assembly, or butt-fusion joints.

APPLICABLE STANDARDS:

Pressure Pipe and Fittings: ASTM D2241, AWWA C900, AWWA C907, AWWA C909, CSA B137.3, CSA B137.3.1, UL 1285, and FM 1612.
Sewer Pipe and Fittings: ASTM D3034, ASTM F679, ASTM F794, ASTM F949, ASTM F1336, ASTM F1803, and CSA B182.2.

LATEST DEVELOPMENT OVER THE LAST FIVE YEARS:

- The Contractor's Installation Guide for Gasketed PVC Pipe has been recently published, providing installers and users with the most up-to-date information (also available in Spanish).
- A Life Cycle Assessment (LCA) in accordance with ISO 14040 series was published showing that PVC pipe has the lowest environmental impacts and life cycle costs as well as the lowest embodied energy and carbon footprint of all pipe materials.
- An ISO 14025 compliant Environmental Product Declaration (EPD) certified by NSF International was re-issued for PVC water and sewer pipe. The EPD transparently discloses the environmental impacts of PVC pipe.

WHAT IS NOTABLE ABOUT YOUR PIPE:

PVC water and sewer pipe has been in service in North American for 70 years, with more than 2 million miles installed. According to a 2018 Utah State University report, PVC pipe has the lowest break rate of all commonly used pipe materials in North America. PVC pipe's exceptional performance is due to its robust material strength and corrosion resistance.

Source: Uni-Bell PVC Pipe Association
Web: www.uni-bell.org

NOVAFORM™ THE CHOICE FOR SANITARY SEWER REHABILITATION IN MURRYSVILLE, PENNSYLVANIA

IPEX trenchless, expand-in-place, styrene-free PVC liner provides for fast, clean and environmentally friendly installation

IPEX by aliaxis

Sizes:
6” – 36”

Contractor:
Snyder Environmental Solutions

Municipality:
Murrysville, Pennsylvania

- Trenchless Product
- Fast Installation
- Minimal Disruption
- A Fully Structural Liner
- Environmentally Friendly

THE CHALLENGE

Murrysville, Pennsylvania, a town of 21,000 people about 45 minutes from downtown Pittsburgh, was experiencing the deterioration of terra cotta sanitary mainline sewers installed more than 50 years ago. An environmental protection order required the Franklin Township Municipal Sanitary Authority to eliminate all sanitary sewage overflows during rain events.

Additionally challenging, Franklin Township’s wastewater treatment plant has a limited amount of capacity left to service new homes beyond its existing 11,000 customers. So fixing defects to prevent inflows or infiltrations that tax the system was critical.

Terra cotta pipes require joints approximately every four feet which pose an increased risk of infiltrations and failure points, along with localized points where materials flowing through the pipe will collect and cause blockages.

This project required working off-the-road allowance and through a forested area, a huge challenge where trenches must be dug or heavy equipment is needed for conventional pipe installation methods.

Minimal disruption to the existing infrastructure when NovaForm is installed

THE SOLUTION

The municipality in Murrysville has worked with IPEX before and knew its NovaForm™ relining product could repair the failing pipes in place without digging, which is costly, time-consuming and disruptive for homeowners and businesses.

NovaForm™ offers a trenchless, expand-in-place option to repair sanitary sewers and stormwater pipes (alternatively called pipe-in-place) that is fast, clean and effective, while respecting the environment. Unlike the existing terra cotta pipes in Murrysville, NovaForm provides one continuous, joint-free pipe from manhole to manhole.

NovaForm can be installed to address a range of sewer and stormwater pipe failures such as fully or partially deteriorated host pipes, or corrosion and other defects that will lead to failure down the road. It is available in sizes from 6" to 36" and may be suitable for installation depths of up to 30 feet according to the ASTM F1216 calculation for a fully deteriorated host pipe condition. Also, it can be used to reline a wide variety of host pipe materials such as asbestos cement, terra cotta/clay, corrugated metal and concrete.

This product line is manufactured to meet ASTM F1504 and ASTM F1871 standards and undergoes rigorous testing at the manufacturing facility, on every single production run. So, the qualities of the material are evaluated before the lining material departs the manufacturing plant.

That quality control ensures reliable and durable performance in each installation because NovaForm does not require any manufacturing or curing processes on site, unlike cured-in-place (CIPP) rehabilitations.

> **The municipal customer is so thrilled with the results of this installation that they have just awarded us another $3 million worth of work. We have a backlog of NovaForm™ work, which is definitely a good problem to have. We really believe in this product and working with IPEX has been a great experience. The support we get is great; in terms of the training we received, and the ongoing technical help. If we have any questions, the people at IPEX are always available.**
> **JOHN BILLET, NovaForm Superintendent, Snyder Environmental Services**

NovaForm is heated and conditioned at the job site using steam and then pulled from reels by high-powered winch into an existing sewer/stormwater pipe that remains buried.

Tests include pipe diameters (ASTM D 2122), wall thickness (ASTM D 2122), pipe flattening, pipe impact resistance (ASTM D 2444), pipe stiffness (ASTM D 2412), flexural properties (ASTM D 790), extrusion quality – acetone immersion (ASTM D 2152) and heat reversion (ASTM F1057).

The factory-based production and quality control of NovaForm ensures reliable and durable performance in each installation because it does not require any in-site manufacturing or on-site curing process unlike cured-in-place (CIPP) technology. The latter is heavily reliant on the quality, experience and expertise of the contractor handling the project. With a field-manufactured CIPP liner, human error during installation can quickly lead to failure. Municipalities that have had negative installation outcomes in the past with CIPP are anxious to find a more reliable solution.

Being a Trenchless product, NovaForm can be installed much more quickly than conventional options and in a comparable time frame to CIPP methods. Depending on field conditions, approximately 800 feet of pipe can be installed in a day, with one install in the morning and another in the afternoon. That would be three to four days' worth of work in open-cut installation.

Before liner installation, the existing host pipe is inspected and cleared of roots and other forms of obstructions and then flushed.

The flattened or profiled NovaForm liner (fold pattern varies depending on diameter of liner) is heated and conditioned at the job site using steam and then pulled from reels by high-powered winch into an existing sewer/stormwater pipe that remains buried. The liner is then plugged at both ends and expanded by introducing steam in a controlled fashion thus allowing the liner to form snuggly against the inner diameter of the host pipe. Once the liner is sufficiently expanded, steam is replaced with compressed air so that the pipe cools and hardens, producing PVC pipe with no seams.

Once the plugs are removed, and laterals reinstated with the municipality's chosen method, the PVC liner is ready to use. Unlike CIPP, with NovaForm there's no need to wait for the material to cure before water can run through it because PVC liners do not have any curing process.

After installation, NovaForm greatly simplifies the jobsite inspection process because there is no need for cut-out coupons for post-installation testing as required for cured-in-place pipe as these tests were completed during the Quality Control process at the manufacturing plant.

Adding to its long list of benefits, NovaForm is a highly versatile product. The Murrysville installation included a segment with manhole access that was off the road allowance and through a forested area. IPEX's expand-in-place product meant trees did not have to be sacrificed. NovaForm is the best choice in many other applications, such as those requiring access under bridges or in proximity to buildings.

To expand on a major advantage of NovaForm, it has no negative environmental impact. In cured-in-place projects, when the material is exposed to steam to create the chemical bond between resin material, there is an airborne release of styrene particles, which is a hazardous material. If there is a dry trap in a nearby school, home or hospital, it could lead to the migration of the styrene-filled steam into those buildings. In most cured-in-place installations, curing liquid contaminated by styrene must be captured and treated.

In contrast, NovaForm PVC liner is simply heated and cooled to expand into hard and durable PVC pipes. That produces no by-product except warm water from steam condensation.

By-Product Comparison between Cured-In-Place & NovaForm PVC Liner

THE RESULTS

Murrysville has used NovaForm on multiple occasions over the last several years and municipal staff have become steadfast supporters of the product. Public works officials happily share their positive experiences with IPEX. This installation happened in a fraction of the time of other methods, provided immediate results and caused minimal disruption. NovaForm has quickly proven itself as a terrific alternative to other forms of trenchless pipe replacement and repair.

IPEX also provides extensive hands-on and on-the-job training to contractors, so they fully understand the product and installation process.

SNYDER Environmental Services, the contractor on this project made the decision to use NovaForm for Murrysville project based on their positive experience with the product and IPEX in the past. The company has provided trenchless services since 1979 and has become an enthusiastic proponent of NovaForm. Thanks to the success of Snyder's projects, contractors in other regions are interested in what the product has to offer.

4 TAKEAWAYS

• Fast Installation
Once NovaForm has been expanded and cooled, it is ready for service. Laterals can be quickly reinstated robotically, and the line can be placed back into service the same day – often only four or five hours from start to finish.

• Minimal Disruption
NovaForm requires no costly, time-consuming and dirty digging, which means there is very little disruption to traffic or the environment. Once the pipe is installed and the crew departs, there is virtually no sign they were ever there. No restoration work to the asphalt, sidewalk or ground is required, which also cuts the time on site.

• A Fully Structural Liner
NovaForm combines long-term strength with flexibility. It is ideal for projects where access is an issue and digging isn't possible, such as under bridges, close to buildings or in green spaces.

• Environmentally Friendly
NovaForm is the trenchless relining material that does not leave any harmful chemical residues in the air and water. Since this PVC liner does not contain any styrene, its risk of affecting the Installation personnel, neighboring residents and the environment is nonexistent.

NOVAFORM™
PVC LINER

Now Available in
6" – 36"

NovaForm™ PVC Liner

Styrene-Free Structural Liner for Sewers and Culverts

The need for a durable and cost-efficient pipe rehabilitation solution has never been more paramount. The engineers at IPEX recognized this need and have responded with NovaForm™ PVC Liner, a product that brings the lasting benefits of factory-made PVC pipe to the North American trenchless pipe rehabilitation industry.

Flexible, Durable and Reliable

Time and Cost Savings

Limits Environmental Disruptions

To learn more, call or visit us at:

1-800-463-9572 | ipexna.com

IPEX by aliaxis

Westlake Pipe & Fittings

SEGMENTAL PVC PIPE SUPPORTS SOLUTION FOR MORE RESILIENT WASTEWATER SYSTEM RECONSTRUCTION AFTER MAJOR HURRICANE

Westlake Pipe & Fittings

Image courtesy of NASA

Addressing the Seabrook, Texas, Main Street Wastewater Treatment Plant's (MSWWTP) vulnerability to hurricanes became a critical task after Hurricane Ike devastated the Texas coast in 2008. With the potential for major damage to the wastewater system along with service disruptions, the city faced the challenge of finding a solution that would protect the plant, minimize disruptions, maintain the resiliency of the infrastructure, and ensure continuous service to its residents.

Challenge

Seabrook, Texas experienced the impact of Hurricane Ike when the storm made landfall on the Texas coast the morning of September 13, 2008. The powerful category 4 hurricane ranked as the third most destructive in U.S. history and the wind's immense power led to storm surge waves as high as 25 feet within Galveston Bay. The city is located approximately 27 miles north of the city of Galveston on the shores of Galveston Bay and at the mouth of Clear Lake.

One of the critical structures affected by Hurricane Ike's storm surge was Seabrook's MSWWTP. The plant was inundated during the hurricane resulting in approximately $1.5 million in damages. After the storm, thanks to the prompt action of Seabrook's Public Works Department, the sewer service was restored to the MSWWTP and all Lift Stations within just five days. Although the control room and structures of the plant are above ground and elevated above current FEMA flooding and surge elevations, the location today presents a number of challenges: subsidence issues, the proximity to Galveston Bay, and if overtopped, the risk of structural failure of the walls along with the associated overflow leading to the discharge of untreated wastewater into the bay, all which emphasize the need for an improved facility location.

ApplicationIn the aftermath of Hurricane Ike, one of the crucial tasks was to address the vulnerability of the MSWWTP to hurricanes of similar magnitude. Along with the low ground elevations, the primary hazard identified at the existing site was the flooding of sensitive components. To provide the plant with longer-lasting protection against flooding and other natural disasters, several alternatives were considered by the city.

The preferred alternative was to construct a new wastewater treatment plant at Pine Gulley (PGWWTP). This site is located further inland at a higher elevation. Currently, the top of the MSWWTP tank walls stand only 1 foot above the Base Flood Elevation (BFE), whereas, at PGWWTP, the walls planned are 20 feet above the BFE. Moreover, the new WWTP will be built to current standards and fortified against hurricanes and other natural disasters. Ideally, this alternative would receive funding assistance from FEMA, enabling construction to be completed within 3 years. The city of Seabrook enlisted the services of Cobb, Fendley & Associates, Inc. (CobbFendley) to assist the city's emergency management planners in the application process for federal assistance; with funding approved, the projects moved forward.

The team first looked at the current process where all the wastewater treated by the MSWWTP flowed into the MSWWTP lift station. One option was to leave the system as-is, allowing the entire volume of wastewater to reach the existing MSWWTP lift station and then pump the wastewater to the new PGWWTP. Reviewing this scenario, CobbFendley proposed an alternative option. They suggested intercepting the wastewater from 6 existing lift stations that are closer to the PGWWTP and rerouting the path directly to the new plant instead of following the current process. By implementing the new approach, approximately 50% of the service area would no longer rely on a single lift station near the MSWWTP, and this option also provided construction flexibility. The alternative approach was approved, resulting in the installation of 21,500 feet of new sewer force main pipe to redirect the sewage flow to the new treatment plant at Pine Gulley.

Solution

Horizontal Directional Drilling (HDD), a trenchless application, was selected as the installation method. This application offered minimal disruption to surface structures, the ability to cross roads and driveways without closures, and efficient installation in congested, primarily residential, rights-of-way.

Several pipe options were considered for the force main, butt fused HDPE, butt fused PVC, and segmental restrained joint (RJ) PVC. Ultimately, segmental C900 Certa-Lok® RJ PVC pipe from Westlake Pipe & Fittings was chosen as the optimal solution offering the cartridge assembly option; the fused pipe options considered required modifications to the HDD pulls and these solutions were found to be too time consuming and ultimately unable to meet the demands of the project. The green color coding of PVC, whether fused or segmental, was also an advantage for the relatively shallow bury depths as it provided an easy identifier for the wastewater pipe system.

The cartridge style segmental PVC approach involves assembling the pipe string during the pullback operation. Pullback occurs one drill rod at a time and there is a pause every time a drill rod is disconnected and re-racked. The new joint of segmental pipe can be connected to the pipe string during

these pauses and the pullback operation can continue at the usual pace. TCH Directional Drilling, the general contractor, was very familiar with the segmental product and expressed no concerns about pipe-string assembly slowing the pullback operation. Moreover, there were specific HDD project sites where this approach was preferred.

"The ability to cartridge feed Certa-Lok during pullback without risking the integrity of the pipe and or gaskets is a major advantage of Certa-Lok over other pipe products when planning and executing HDDs in congested areas as we encountered in Seabrook where space to string out pipe is limited," said Samuel Free, project manager TCH Directional Drilling. "The speed and ease of using Certa-Lok's coupling system to connect joints significantly reduce the amount of time and manpower required to perform drilling operations over other products that require fusion or welding to join."

Certa-Lok segmental PVC pipe is available in 20-foot or 40-foot lengths. TCH Directional Drilling chose the 40-foot option for increased efficiency and to reduce labor. Opting for 40-foot lengths also resulted in a more cost-effective solution. In addition, Westlake Pipe was available on site to provide support during the project.

Throughout the planning phase, resiliency was a top priority. To better facilitate maintenance, shallower profiles for the HDD bores were specified instead of the typical depth. The shallower depths, however, required additional measures to address potential inadvertent return of drilling fluids leading the design firm to require multiple relief pits along the installation path.

Grade control also received significant attention. An air relief valve is required at every high point in a force main and poor grade control could result in unexpected local high points. Using a walkover system to monitor both the depth and direction of a horizontal drill gives operators real-time feedback and enables constant adjustment of the drilling direction. TCH Directional Drilling used a Digital Control Inc. walkover tracker during the HDD process to ensure grade was maintained within tolerance.

As of the end of January 2023, 10,000 LF of 14-inch C900 Certa-Lok DR18, RJ, PVC; 5,300 LF of 12-inch C900 Certa-Lok DR18, RJIB, PVC; and 5,300 LF of 20-inch C900 Certa-Lok DR18, RJ, PVC or 92% of the total 21,540 LF of force main pipe has been installed. Due to outside constraints with the construction of the PGWWTP, the new force mains will not be placed in service until early 2024. All work by TCH Directional Drilling has progressed on schedule and within budget.

Go Trenchless with **Westlake Pipe & Fittings**

For horizontal directional drilling and static pipe bursting projects, get the job done efficiently with AquaSpring™ C900 Certa-Lok® RJIB PVC Pipe or AquaSpring™ C900 Certa-Lok® RJ PVC Pipe. They're specifically designed for trenchless applications with robust tensile strength for pulling multiple segments underground. Our AquaSpring™ C900 Certa-Lok® RJIB pipe is available in sizes 6" - 24", so you can take on almost any job.

Westlake
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Learn more at **westlakepipe.com/trenchtech**

STEEL PIPE

TRENCHLESS APPLICATIONS:

Horizontal directional drilling, jack-and-bore and pipe ramming

BEST SUITED FOR:

Water and wastewater transmission, gas and oil transmission, water well casing, pile driving and caisson sleeves.

NOT WELL SUITED FOR: :

Chemical or corrosive service without internal or external protective coatings.

HOW IS IT DELIVERED:

Steel pipe is generally supplied in laying lengths 20 to 60 ft. Some diameters of pipe can be manufactured in lengths up to 120 ft or longer without a girth mid-weld.

DESIGN LIFE:

The design life of steel pipe is based on the mechanical strength of steel which is fully elastic and not time dependent. If properly installed, with the appropriate lining and coating, steel pipe with the addition of electrical bonding and cathodic protection (if required) can last indefinitely.

HOW IS IT JOINED:

The most common method of assembling steel pipe is by field welding or bell and spigot joints with rubber o-ring gaskets, other methods include threading and coupling or compression fittings.

AVAILABLE DIAMETERS:

Steel pipe is available in diameters 4 in. and larger with virtually an unlimited choice of fitting and special fabrications possible.

APPLICABLE STANDARDS:

AWWA standards include C200 and Manual of Standard Practice for the Design and Installation of Steel Water Pipe M11, ASTM standards for steel pipe include A53, A106 A139, A252. The most common API standard for steel pipe is API 5L

LATEST DEVELOPMENT OVER THE LAST FIVE YEARS:

Advancements in the use of cementitious and non-cementitious materials and admixtures continue to provide greater strength, longer durability, and more sustainable products. Additionally, manufacturing equipment and processes continue to evolve and improve product quality. In the last five years ASTM Standard C1885 has been developed for the manufacture of concrete jacking pipe, and ASTM C1941 has been developed for the manufacture of precast concrete box culverts for jacking.

WHAT IS NOTABLE ABOUT YOUR PIPE:

The performance resume for steel pipe dates back to the early 1850s. This experience in pressure applications for water, gas and petroleum fluids cannot be matched by any other pipe material, particularly those made from plastic materials that are visco-elastic, where the material strengths erodes overtime. Steel pipe, with its simple, straight-forward design procedure and pragmatic installation requirements, is finding its way into project specifications once dominated by pipes of composite construction. STI/SPFA member companies are certified for the SPFA Certification program by Lloyd's Register Quality Assurance. This provides owners and engineers with assurance that their steel pipe is manufactured in strict accordance with applicable AWWA, ASTM and other standards and industry accepted practices.

Source: Steel Tank Institute/Steel Plate Fabricators Association (STI/SPFA)
Web: steeltank.com

VITRIFIED CLAY JACKING PIPE (VCP-J)

TRENCHLESS APPLICATIONS:

Pilot tube method (PTM) of guided boring, microtunneling, slurry microtunneling, static pipe bursting, sliplining existing pipe and casing.

BEST SUITED FOR:

Gravity flow sanitary sewers

NOT WELL SUITED FOR:

Pressure applications

HOW IT IS DELIVERED

VCP pipe is available in a variety of stock and custom lengths, depending on diameter, jacking frame and shaft size. Common lengths are 1 and 2 meters.

APPLICABLE STANDARDS

ASTM C1208, EN 295-7

DESIGN LIFE:

200-plus years

HOW IS IT JOINED:

Low-profile compression joints with 316 grade stainless steel collars.

AVAILABLE DIAMETERS:

8 to 24 in. I.D.

LATEST DEVELOPMENT OVER THE LAST FIVE YEARS:

The pilot tube method of guided boring with VCP reliably achieves precision drives of more than 400 LF. VCP is also used as the replacement pipe in static pipe bursting resulting in a rigid, abrasion resistant, long-lasting, gravity flow conduit. VCP was the first pipe material to have a standard for cleaning and maintaining gravity sanitary sewers (ASTM C1920).

WHAT IS NOTABLE ABOUT YOUR PIPE:

VCP jacking pipe is the leading small diameter, direct-jacked pipe material. It delivers unrivaled compressive strength (an average of 18,000 psi), low profile, zero-leakage joint and a proven unmatched service life. Vitrified clay is a fired ceramic with material properties unaffected by age, light or chemicals. The exceptional durability of VCP allows for aggressive cleaning tools and techniques. Today's vitrified clay jacking pipe, coupled with trenchless installation methods, allows municipalities to design, construct and maintain the most sustainable collection systems.

Source: National Clay Pipe Institute
Web: ncpi.org