

UTILITY SERVICE

Ice Pigging

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Utility Service: Overview



- Leading US provider of water tank asset management
- Manage over 6,000 water towers in full asset programs
- Completed over 1,300 renovations in 2013
- More than 3,000 clients in over 42 states
- Perform over 6,000 condition assessments per year
- 300 employees - 44 field representatives geographically organized
- 10 Production & Logistic Centers

Utility Service: Services



- Tank Cleaning and Painting
- Chemical Cleaning
- TRS
- In Tank Mixing
- Ice Pigging water and waste water
- Valve and Hydrant Services
- Water Metering (AMI)
- Water Well Service

ICE PIGGING

A Sustainable Best Practice for Cleaning Water Mains and Force Mains



What you will learn ...

- **What is Ice Pigging**
- **How is it used**
- **Case studies**



What is Ice Pigging?

A patented innovative *sustainable* pipe cleaning technology to improve water quality and asset management

**Designed in Europe
several years ago**

**Designed for cleaning
Water Lines**



How does it work?



Ice Pigging harnesses the characteristics of a semi-solid material

- **An ice pig is a semi-solid material that can be pumped like a liquid**
- **But behaves like a solid once the pig is formed in the pipe**

Controlling the semi-solid state



To maintain the correct consistency of the Ice Pig during an operation a **freezing point depressant is used**

- **NSF approved additives (NaCl) as freezing point depressants**
- **Additional chlorine maybe added**

What Ice Pigging Can and Cannot Do:

Can:

- Remove sediment, bio-film, debris, and FOG
- Be pumped in and out of hydrants
- Clean between 1-2 miles/day
- Clean up to 18 inch diameter pipes (larger possible)
- Clean Water Mains, Raw Water lines **and Force Mains**

What Ice Pigging Can and Cannot Do:

Cannot:

- Remove heavy tuberculation
- Remove hard water deposits
- It is not a pipe rehabilitation method

Why Clean pipes?

Cleaning pipes improves customer service & reduces costs:

- Reduce discolored water complaints
- Improve water quality compliance
- Reduce biofilm deposits
- Reduce THM production
- Remove iron and manganese build up



Why clean Force Mains?

- **Maintain and restore flow rates**
- **Odor issues**
- **Pumping costs**
Sediment build up reduces the pipe capacity in turn increasing the pumping costs

Sediments



Associated problems:

Turbidity



Taste & Odor Issues

Customer complaints



Traditional Cleaning Techniques

Cleaning devices:

Flushing, air scour and jet washing



Operational problems

- Inefficient
- High Water Usage
- Customer service affected
Long interruption to supply

Traditional Cleaning Techniques

Cleaning devices:

Pigs



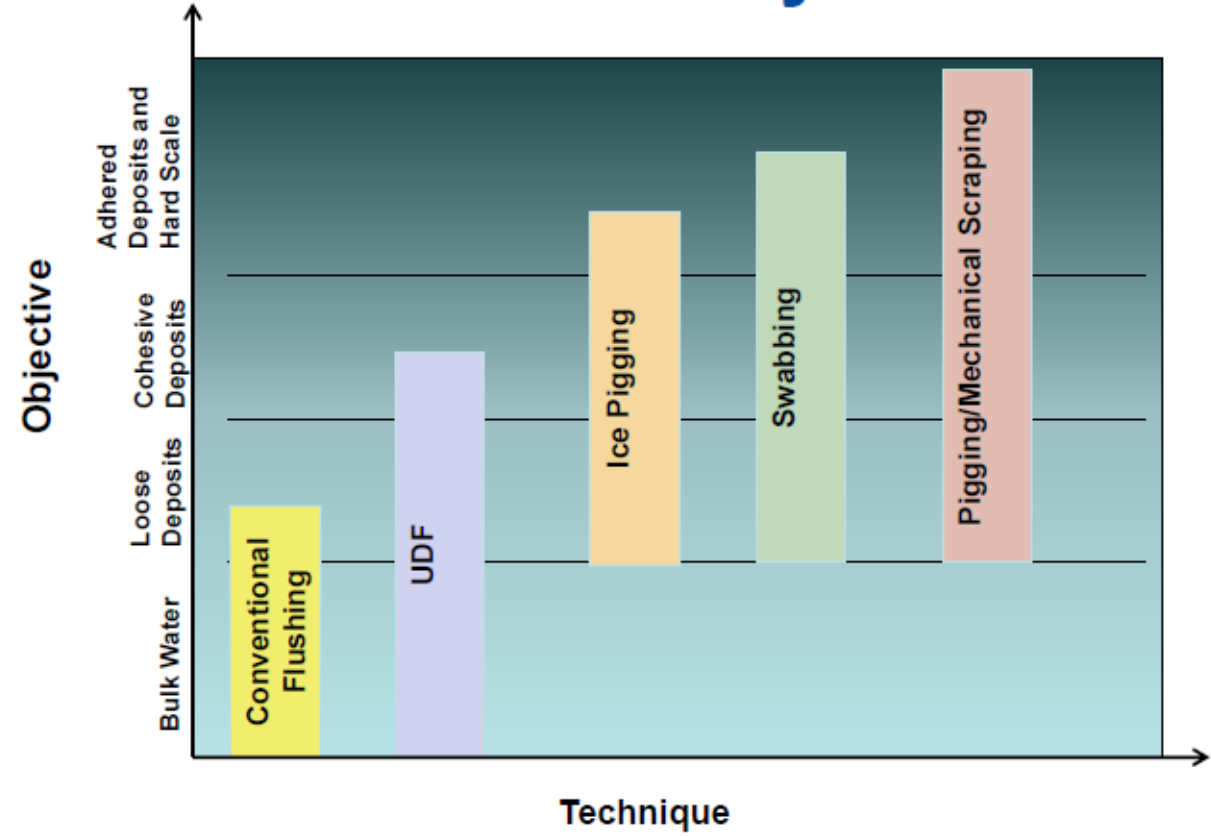
Swabs



Operational problems:

- **Incompatible with pipe bends and changes in diameter**
- **Requires Excavation**
Excavate to launch and receive pigs
- **Customer service affected**
Long interruption to supply

Main Cleaning Comparative Summary

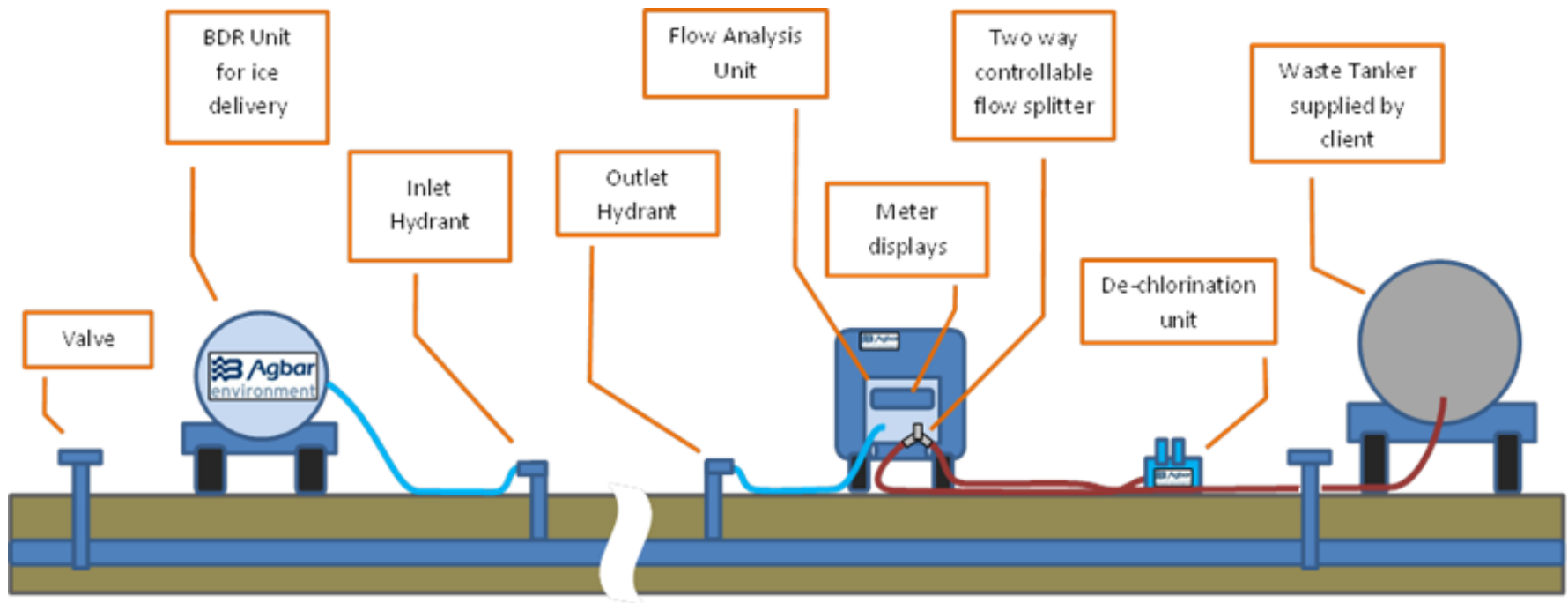








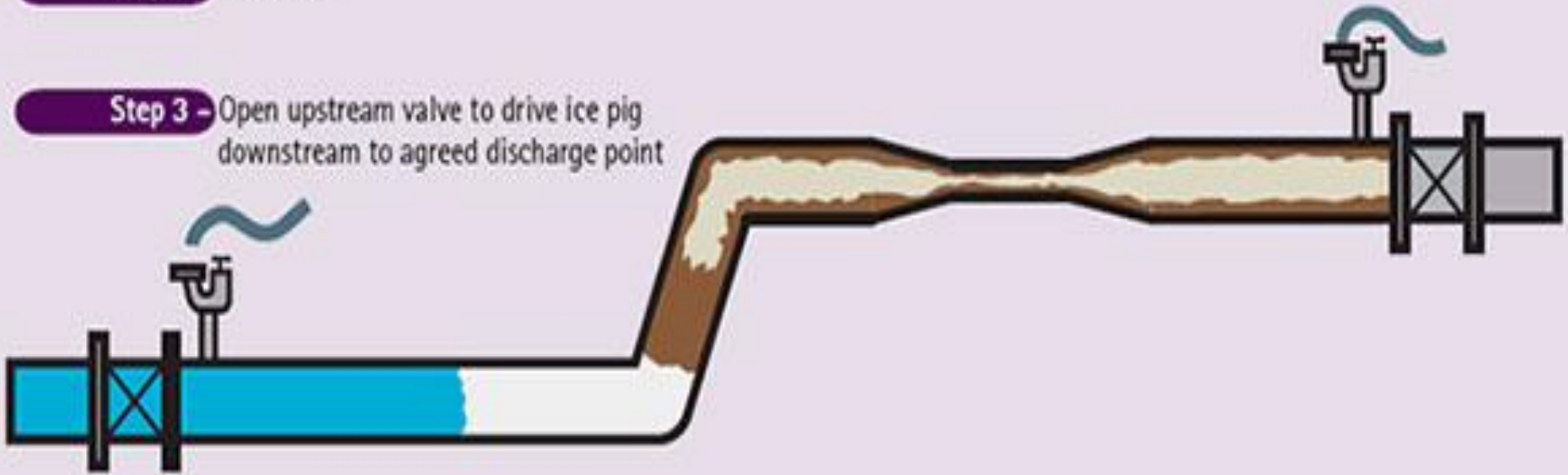
Ice Pigging in Practice:



Step 1 - Isolate main

Step 2 - Insert ice

Step 3 - Open upstream valve to drive ice pig downstream to agreed discharge point

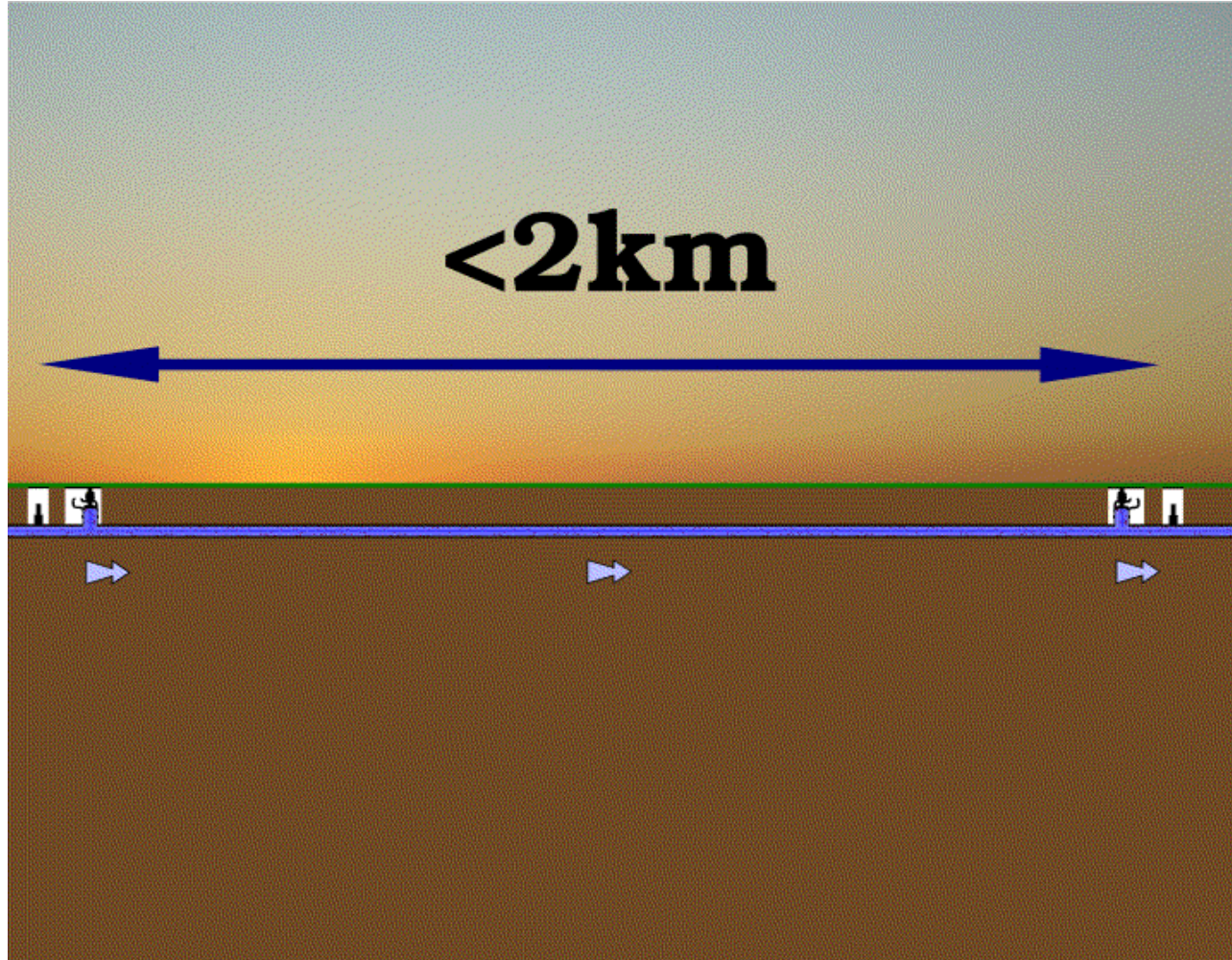


Step 4 - Collect ice pig

Step 5 - Flush and return to service

Ice Pigging in Practice:

Less than 1.25 miles



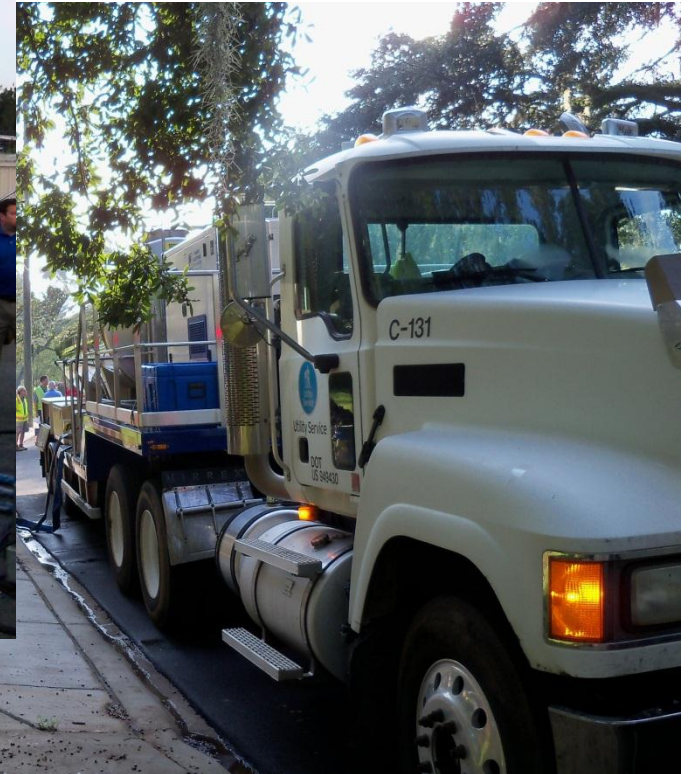
Ice Pigging in Practice:

Custom built equipment



Ice Pigging in Practice:

Custom built equipment



Custom built equipment



Ice Pigging in Practice:

Custom built equipment



Last week in Western Ohio





Ice Pigging in Action:









What comes out:

Actual Samples



- ① Sample from front of pig
- ② Sample from middle of pig as it carries through sediment
- ③ Sample at end of pig where water is clean again

75 Lbs per mile on average -- 1 raw water line we got 800 lbs in 1 mile





Backflow (may look different depending on application)

Ball Valve

Wet Tap

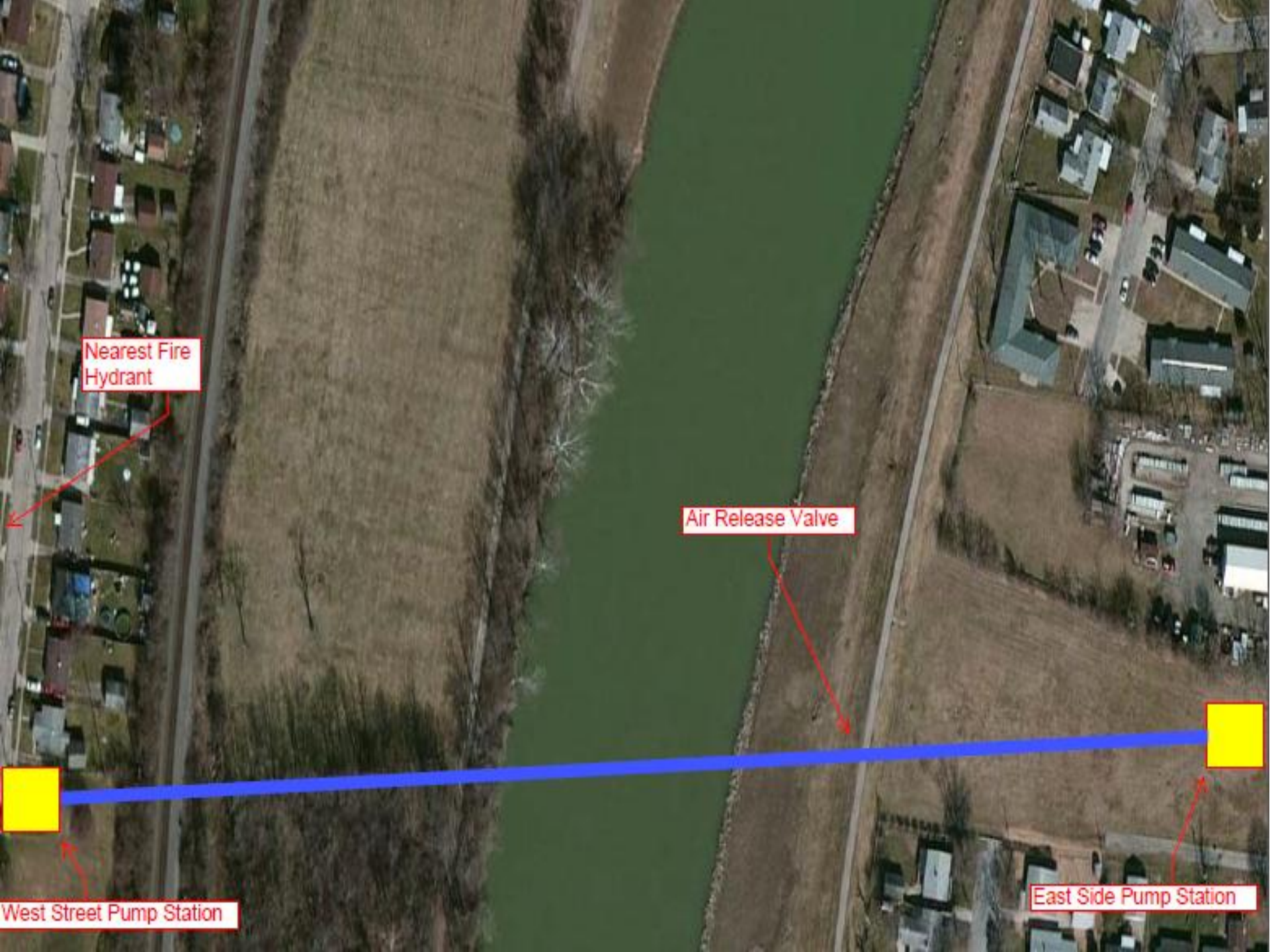




Things to consider when Ice Pigging a Force Main

- **Diameter of the pipe**
- **Length of Main**
- **Material of pipe**
- **Capacity of Wet Well**
- **How do we keep the pumps running**
 - **Fire Hydrant**
 - **Tanker truck**
- **Where will we inject the ice**
- **How will we discharge**
- **Temperature of water in the wet well**





Nearest Fire Hydrant

Air Release Valve

West Street Pump Station

East Side Pump Station

Ice Pigging WW Force Main Improves Pumping Efficiency

- Pre cleaning pump tests conducted on 10/1/2012.
- 2 Ice Pigging runs on 1,200' of 4' diameter cast iron force main on 12/3/13.
- Post cleaning testing conducted on 1/14/2013.

Pre and post pump test results:

<u>Date</u>	<u>Pump 1</u>	<u>Pump 2</u>
10/1/2012	257 gpm	256 gpm
1/14/2013	334 gpm 29.9% increase	325 gpm 25.9% increase

By cleaning the force main and **improving flows over 25%**, the Borough can postpone the capital improvement project, allowing that money to be used more effectively.



Dallastown Borough, PA





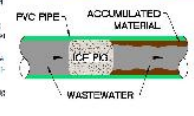
Case Study

American Council of Engineering Companies/Vermont

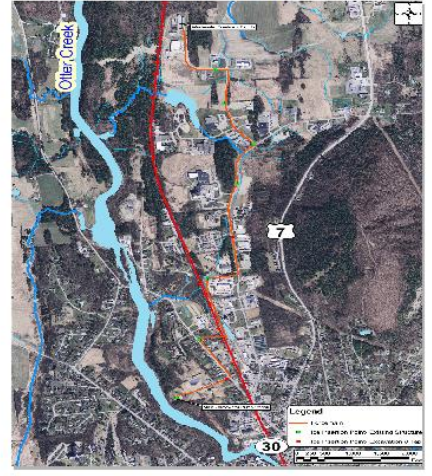
No other company would bid on this job with traditional methods

An Inside Look at Ice Pigging

Ice pigging is up to 1,000 times more effective than water flushing alone. It involves more efficient flushing and is significantly less time and labor intensive than other flushing methods. The concept is to use ice and water to push the pig all the way through the forcemain. Because the pig is made of a solid, it will not get stuck in the forcemain. If the pig does get stuck, it simply melts and resumes its normal cycle. The amount of ice can vary from a few inches around the forcemain, through diameter changes and valves. The semi-rigid consistency allows the ice pig to effectively remove the soft sludge, sediment, sand, debris, sludge, inorganic and organic material. The ice pig works like a plow for the material, pushing debris into the line, then slicing the material like solid pigging.



Map of Forcemain and Insertion Points



Problem & Goal

The Middlebury Main Pump Station pumps wastewater through 22,000 LF of 18" and 36" ductile iron and PVC forcemain to the Wastewater Treatment Facility. The pumps were originally designed to discharge 20,000 gallons per day (gpd). Pumping rates fluctuated by more than 10% over time as the forcemain corroded and became clogged. Due to some wet weather conditions, the pump station could not keep up with incoming flows and raw sewage overflowed as combined flows. Over time CSOs led to the Oiler Creek.

Middlebury's goal was to clean the forcemain by a new, innovative, innovative technology called "Ice Pigging" to replace the ice pigging capacity, eliminate CSOs, improve pump efficiency, and save energy.

Solution

Meeting & Exceeding Middlebury's Needs

- Ice pigging successfully cleaned the forcemain and pump station returned to 6,700,000 gpd.
- Removal of accumulated debris increased capacity of the pump station by more than 843,000 gallons per day.
- Pump efficiency was increased, lowering the pump's time and saving on energy and wear.
- Pigging program was developed to address some of the city's goals for continuous flow.
- The project was completed on schedule and within budget with no field changes or change orders.

Installation at Work

- This was the first use of ice pigging technology to clean sewer forcemain for the 18" diameter in North America.
- This project was the largest continuous run of sewer forcemain (32,000 LF) ever cleaned by ice pigging in North America.

Social & Economic Considerations

- The pump station now operates at full capacity, saving money and eliminating CSOs as the public has to bid the replacement.
- New, efficient, and effective pipe cleaning technology has been demonstrated to the US.

Overcoming Project Specific Complexity

- "Ice pigging" or "solid pigging" relied on pipe size changes, bends, valves, and inlets or outlet stations.
- Number and location of insertion points was determined based on the pipe diameter, pipe length, and the wastewater temperature to make sure the ice pig slurry would hold together as it traversed each pipe segment.
- Use of cutting air release equipment, and tanks for insertion point reference and flow back flow.
- Use of a city's highest than normal wastewater temperature which made this technique challenging.

Providing Technical Value to the Profession

- Praxis ice diameter flow meter was first-of-its-kind and successfully developed by ice pigging.
- On-site training was conducted with operators and engineers from all over New England and upstate New York.

Making the Ice Slurry



The trucking rig is prepared for use later by cooling and mixing a combination of water and salt in the perfect consistency.



The ice slurry mixture acts as both a solid and a liquid. The consistency is very similar to a conventional slurry.

Injecting the Ice Pig



The delivery/insertion truck brings the ice slurry to the location and pumps the slurry into the forcemain.



The slurry being pumped into the forcemain inside a casing at the cast-in-place.

Material Removed



The material on the left shows sediment filled with material removed by the ice pig. The sample on the right shows material removed.



Some of the material removed by the pigging is shown at the Wastewater Treatment Facility.

Sharing What We Learned



Engineers and operators from all over New England and upstate New York were invited to observe the work and learn about the new and innovative pigging process.

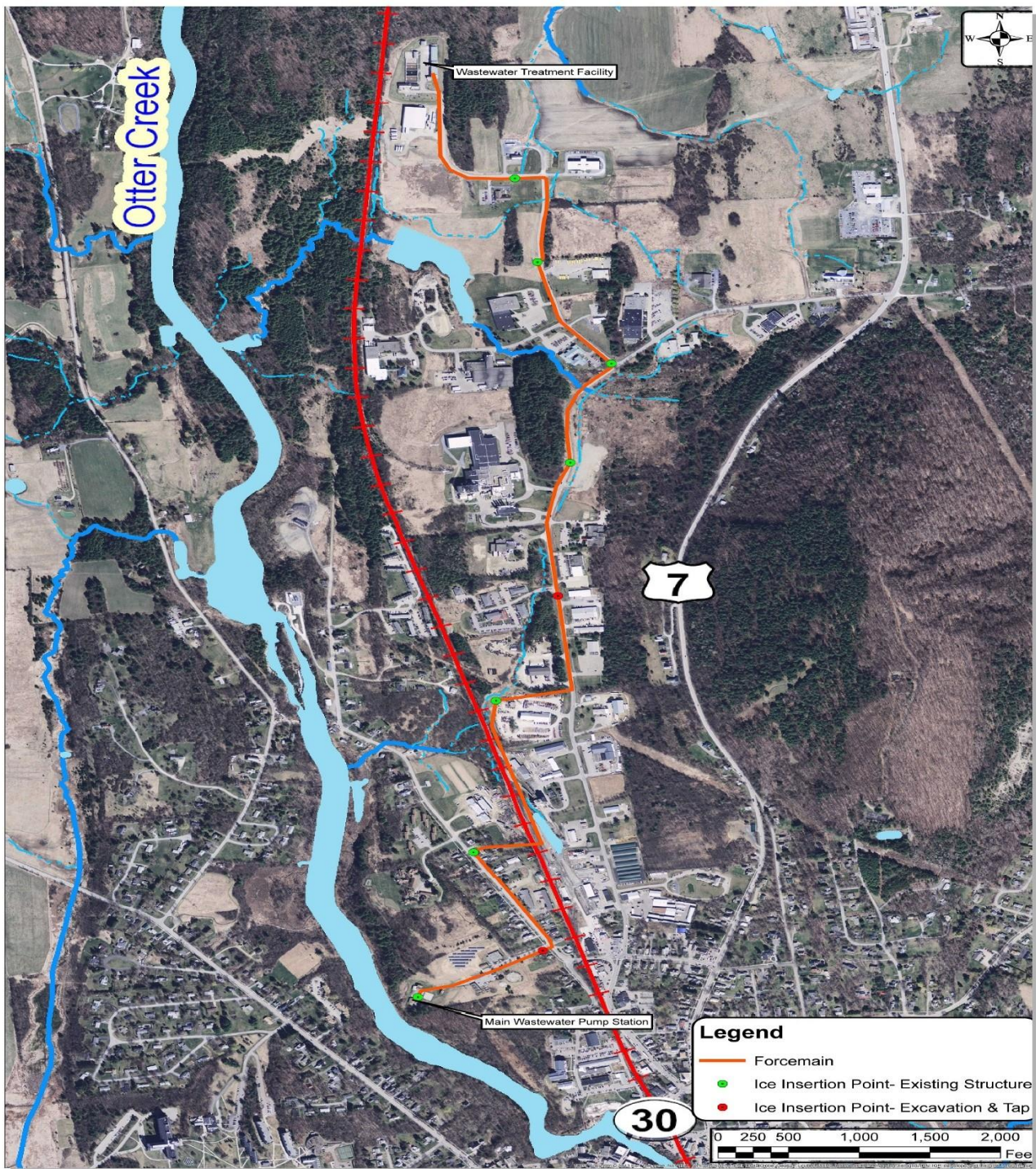


Engineers and operators from all over New England and upstate New York were invited to observe the work and learn about the new and innovative pigging process.

American Council of Engineering Companies/Vermont Section
2014 Engineering Practice Awards Entry
Category: E: Special Projects



The traditional image of an ice pig is forever changed in the minds of professionals learning this new innovative technology.



Problem & Goal

- ▶ The Middlebury Main Pump Station conveys wastewater through 12,000 LF of 16" and 18" ductile iron and PVC force main to the Wastewater Treatment Facility. The pumps were originally designed to discharge 6,200,000 gallons per day (gpd). Pumping rates decreased by more than 10% over time as the force main collected grease, grit, and sediment. During some wet weather conditions, the pump station could not keep up with incoming flows and raw sewage overflowed as Combined Sewer Overflows (CSO's) to the Otter Creek.
- ▶
- ▶ Middlebury's goal was to clean the force main by a new innovative/alternative technology called "Ice Pigging" to regain the lost pumping capacity, eliminate CSOs, improve pump efficiency, and save energy.



Solution

Meeting & Exceeding Middlebury's Needs

- ▶ **Ice pigging successfully cleaned the forcemain and pump rates returned to 6,260,000 gpd.**
- ▶ **Removal of accumulated deposits increased capacity of the Pump Station by more than 640,000 gallons/day!**
- ▶ **Pump efficiency was increased, lowering pump run times, and saving energy and wear.**
- ▶ **The project was completed on schedule and within budget with no field changes or change orders!**

Material Removed



The sample on the left shows influent filled with materials removed by the ice pig. The sample on the right shows normal influent.



Sand, grit, organics, and grease removed by ice pigging are discharged at the Wastewater Treatment Facility.



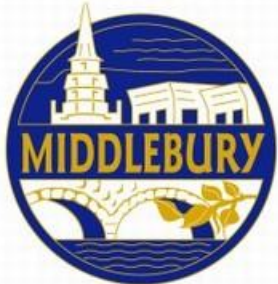
Ice Pigging WW Force Main Improves Pumping Efficiency

- Original design flow rate was 6.2 mgd.
- Decrease in flow rates – Industrial discharge included Cabot Cheese and several breweries.
- 10/4/13 flow rate was 5.62 mgd (3,904 gpm).
- 10/28/13 conducted 9 IP runs on 12' of 16" & 18" force main.

Pre and post pump test results:

<u>Date</u>	<u>Two Pumps Flow Rates</u>
10/4/2013	5.62 mgd (3,904 gpm)
10/28/2013	6.26 mgd (4,347 gpm) 11% increase (640,000 gpd or 444 gpm))

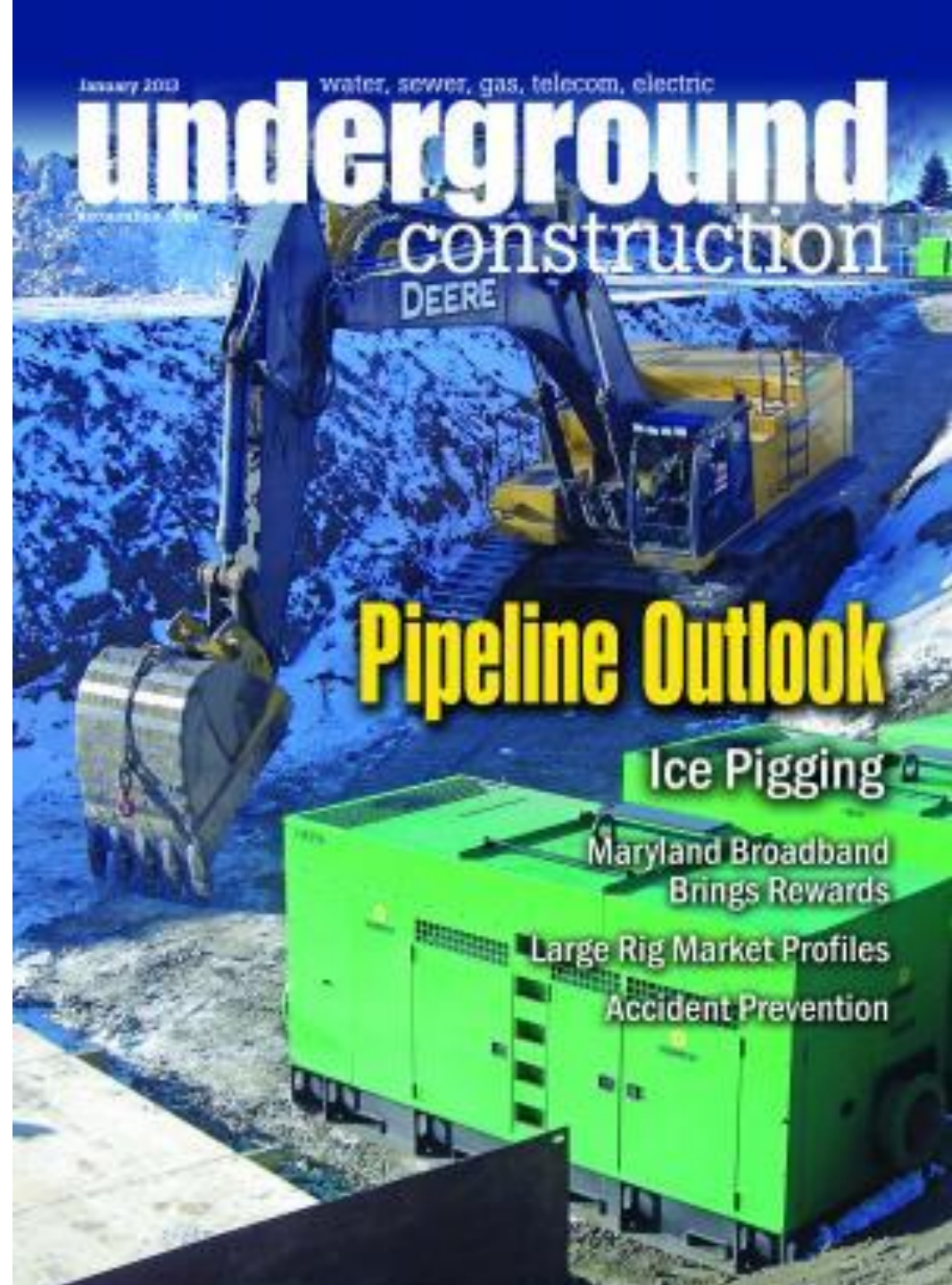
By cleaning the force main flow rates increased to 6.26 mgd (4,347 gpm) for an approximate 11% increase in flow.



Middlebury Wastewater, VT

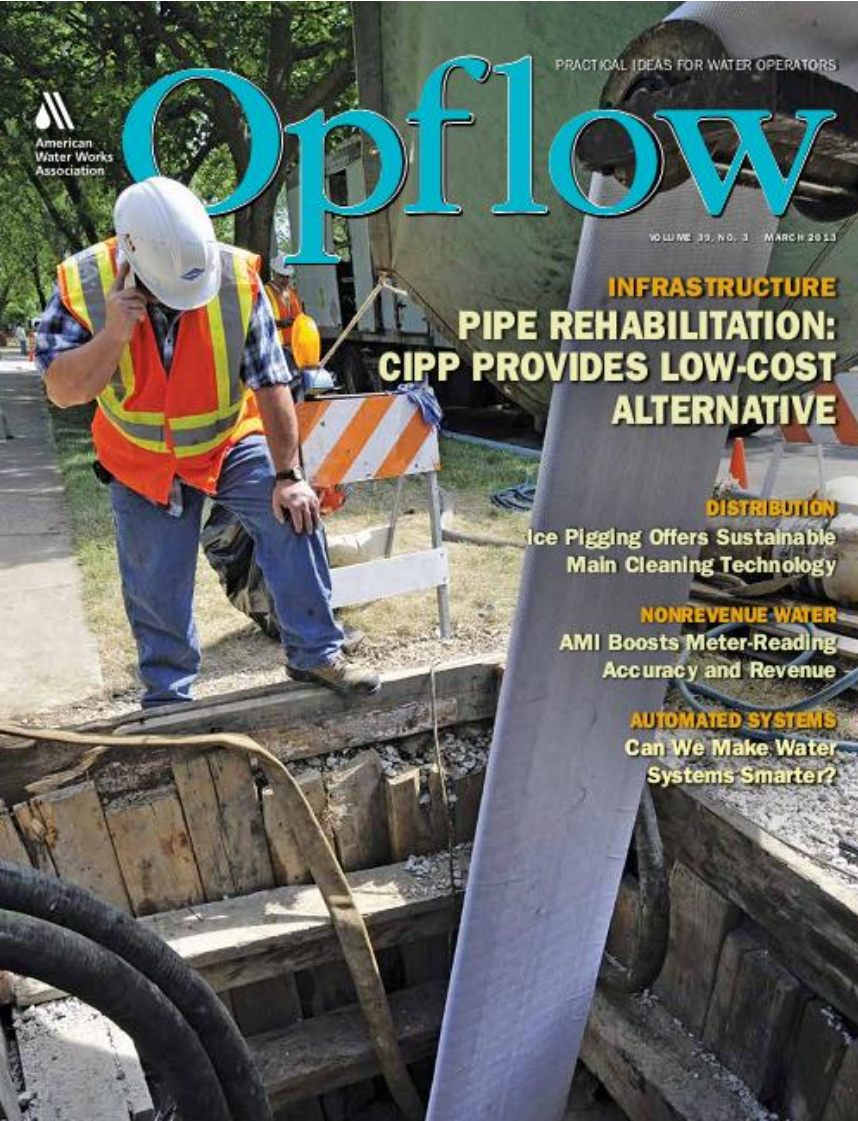


January 2013 Underground Construction



Utility
Service
Group

August 2012 & March 2013 Opflow



INFRASTRUCTURE PIPE REHABILITATION: CIPP PROVIDES LOW-COST ALTERNATIVE

DISTRIBUTION
Ice Piling Offers Sustainable
Main Cleaning Technology

NONREVENUE WATER
AMI Boosts Meter-Reading
Accuracy and Revenue

AUTOMATED SYSTEMS
Can We Make Water
Systems Smarter?



DISTRIBUTION CLEANING MAINS: CLEAN, PIG, OR DIG?

PLANT SECURITY
Commissioning Ensures
System Performance

VALVE MAINTENANCE
Don't Let Your Control
System Control You

WORKFORCE MANAGEMENT
Help Employees Cope
With Change

WATER QUALITY
Control Nitrification With
Online Monitoring



Questions?



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Every Drop Along The Way...