Town of Middlebury, VT Wastewater Force Main Ice Pigging Project

NEWEA Annual Conference

January 28, 2015

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Overview

1. Project Background

2. Ice Pigging Technology

3. Middlebury Sewer Forcemain

4. Lessons Learned & Outcomes

5. Q&A

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Project Background

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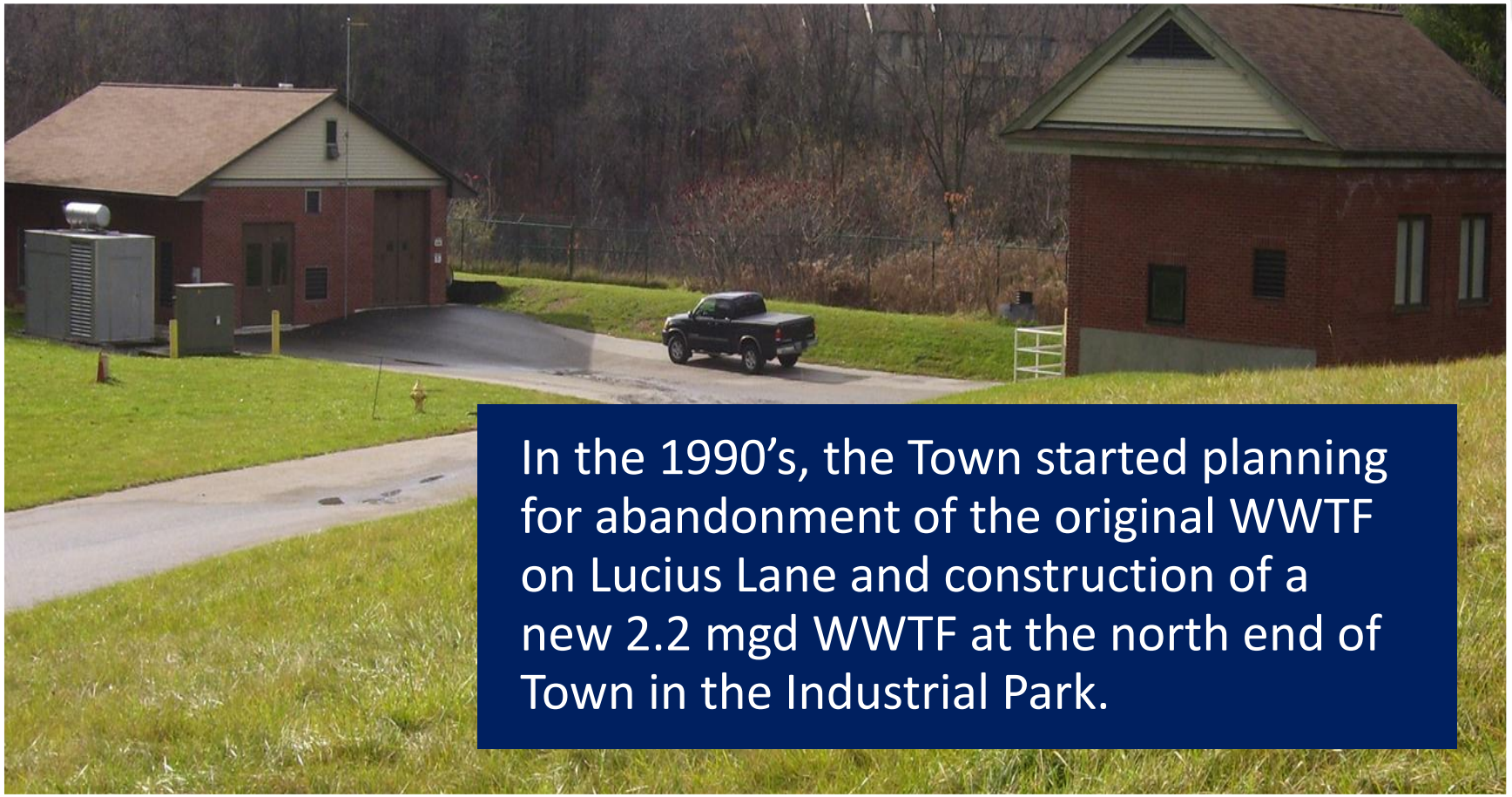
History



In the 1990's, the Town started planning for abandonment of the original WWTF on Lucius Lane and construction of a new 2.2 mgd WWTF at the north end of Town in the Industrial Park.

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History

New sequential batch reactor WWTF placed into operation in 2001.

History

Old WWTF converted to a Main Pumping Station with about 12,000 lf of new 16” and 18” DI and PVC forcemain to convey wastewater to WWTF.

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Main Pumping Station

Screenings building with Lakeside mechanical screen.

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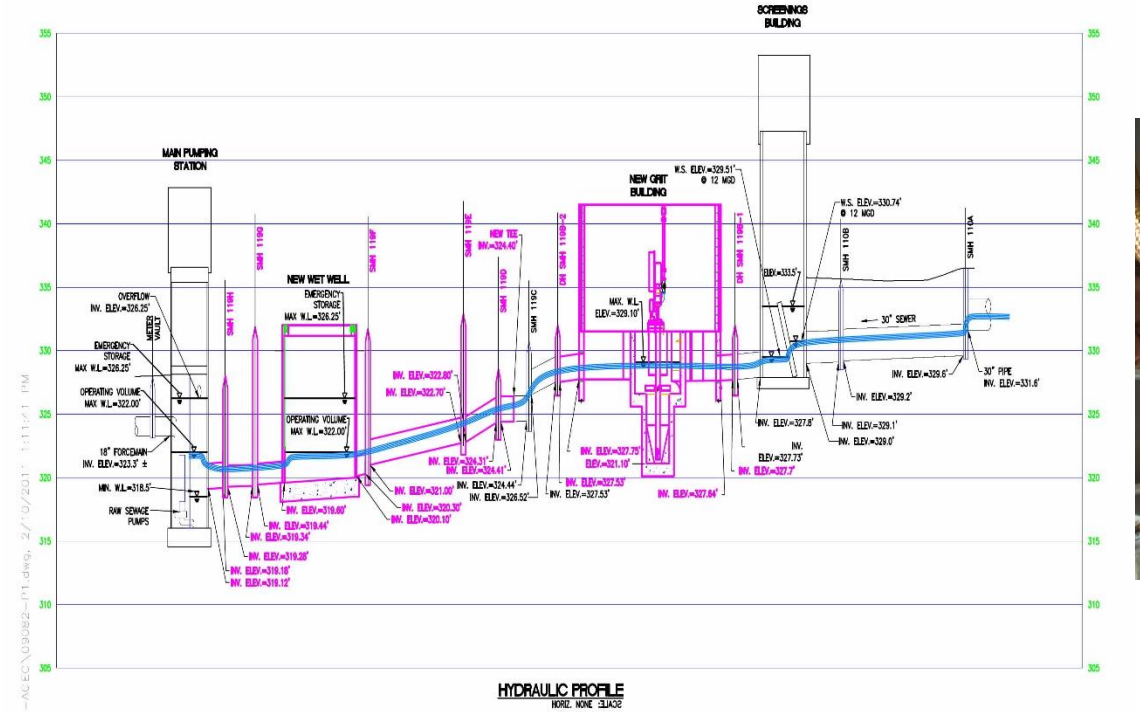
Main Pumping Station



Dry pit with three (3) centrifugal pumps. Two pumps operating to provide a peak flow of 6.2 mgd (4,300 gpm).

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Main Pumping Station

Reused existing 2 cell wet well.

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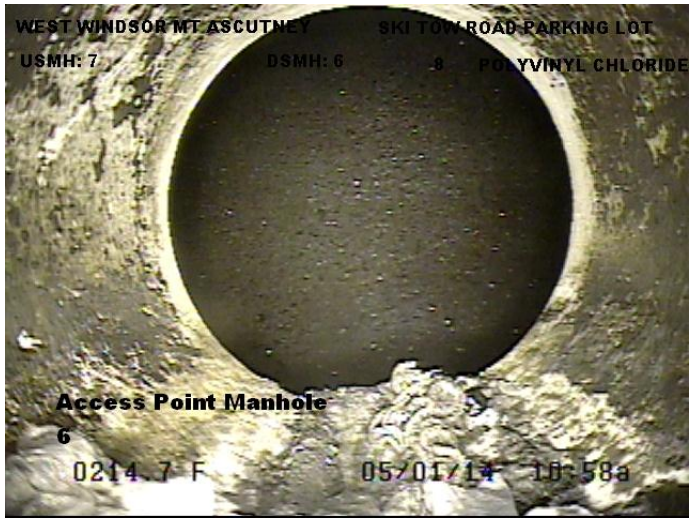
Problem

- ✓ Pumps were originally designed to discharge 6.2 mgd. Capacity with two pumps operating had decreased to < 5.0 mgd.
- ✓ Wet well is undersized with limited operating volume and emergency storage.
- ✓ During extreme wet weather conditions, the pump station could not keep up with incoming flows and combined sewer overflows (CSO's) were discharged to Otter Creek.

Investigation

- ✓ Study was completed in 2005 to evaluate the wet well, pumping capacity, and forcemain.
- ✓ Town staff believed that grit accumulation in wet well and forcemain was primary cause of reduced pumping capacity.



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CSO Monitoring

- ✓ During Discharge Permit renewal, the Town received a "Condition" that the CSO outfall be monitored through May 31, 2011, to determine compliance with CSO Control Policy.
- ✓ Monitoring of rainfall and overflow frequency, duration, and volume started in 2007.

  - ✓5 events recorded
  - ✓Maximum flow ranged from 583 to1,122 gpm.
  - ✓Volumes up to 84,000 gallons

CSO Abatement Improvements – Phase I

- ✓ Town passed a $1.8 m bond vote in October 2009 which included a $900,000 ARRA subsidy.
- ✓ Project included:
  - ✓ Wet well expansion
  - ✓ Grit removal system
  - ✓ Screenings Building upgrades

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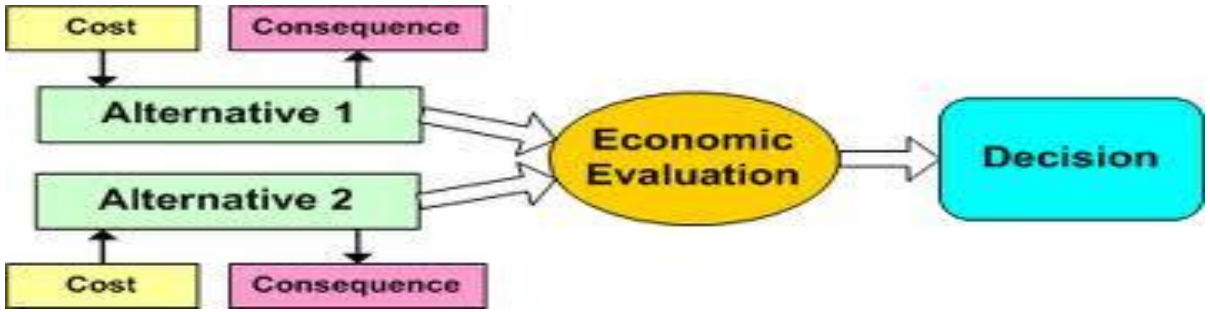
Next Steps – Phase II

- ✓ CSO improvements abated overflow and allows for operational flexibility with larger wet well volumes and emergency storage
- ✓ Town still wanted to return pump station capacity to 6.2 mgd by cleaning forcemain
- ✓ Alternatives wer evaluated for forcemain cleaning



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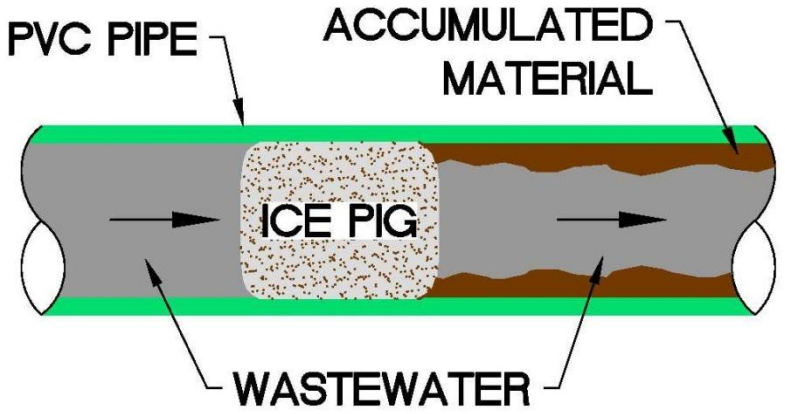
Goals

Middlebury's goal for cleaning the force main was to:

- ✓ Regain the lost pumping capacity
- ✓ Improve the pumping efficiency
- ✓ Save energy



Ice Pigging Technology

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What is Ice Pigging?

An innovative pipe cleaning technology to improve **water quality, flows** and **preventative maintenance**

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Why Ice Pigging?

- **Remove the "crud" build up that impacts water quality and restricts flows.**
  - ✓ **BIOFILM, organic matter**
  - ✓ **Sediment, debris, sludge, oils & greases**
  - ✓ **Iron and Manganese**

ICE PIGGING

- **Benefits**
  - ✓ **Improve flow rates**
  - ✓ **Reduce pumping costs**
  - ✓ **Reduce Residual Demand**
  - ✓ **Improve water quality (DBPs)**
  - ✓ **Reduce customer complaints (odor, taste, color)**
- **<u>Protect your ASSETS</u>!**
  - ✓ **Keep clean & extend life**

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Traditional Cleaning Techniques

Flushing

Challenges:

- **Not enough velocity**
- **Resource Allocation**
- **High Water Usage**

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Traditional Cleaning Techniques

Cleaning devices:

Pigs

Swabs

Challenges & Risks:

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

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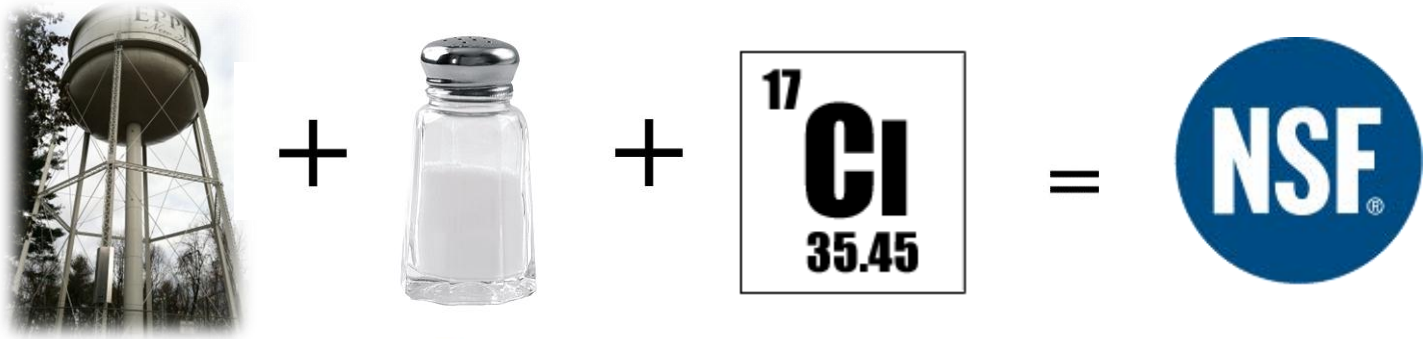
Where is that Pig?

Ice Pigging Advantages:

- Exceptionally low risk
- Low water usage
- 1000x more effective than flushing
- Goes around bends, 90 degrees, butterfly valves
- Adapts to changes in diameter
- Efficient and fast
- Green process

What is the Ice Pig?

- **Potable water typically from the utility**
- **Food grade salt - Typically 5%**
- **Chlorine for disinfection (customer request only)**
- **NSF certified**



How does Ice Pigging 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**

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Custom built equipment

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Make the ice

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Transport the ice

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Insert the ice slurry – Ice Pig

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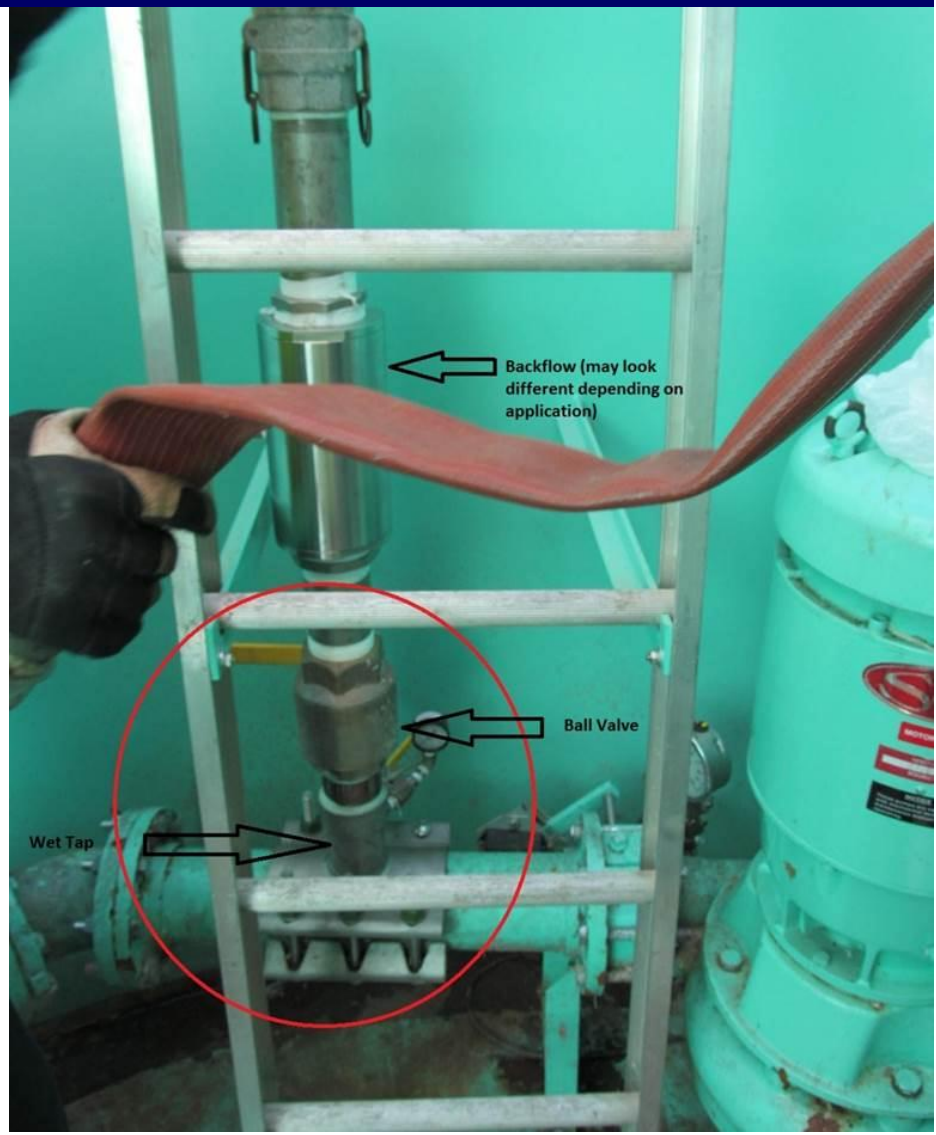
Insert the ice slurry – Ice Pig

Wastewater Connection

- 2” insertion point
- PRVs



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Discharge

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Disposal

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Field Monitoring

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Project Considerations:

- ✓ Map of pipeline with hydrants, valves, & scale to determine pipe lengths
- ✓ Pipe diameters and type of pipes
- ✓ Water Temperatures
- ✓ Ability to isolate mains
- ✓ Valve & Hydrant exercising
- ✓ Discharge solution – sewer, tanker or land discharge (permits may be required)
- ✓ Police or flaggers
- ✓ Public notification – water customers

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Types & size of pipes:

- ✓Asbestos cement lined
- ✓Cast Iron
- ✓Ductile Iron
- ✓Steel
- ✓PVC
- ✓Plastic
- ✓Sanitary force mains and siphons
- ✓ ¾” up to 24” pipe diameter

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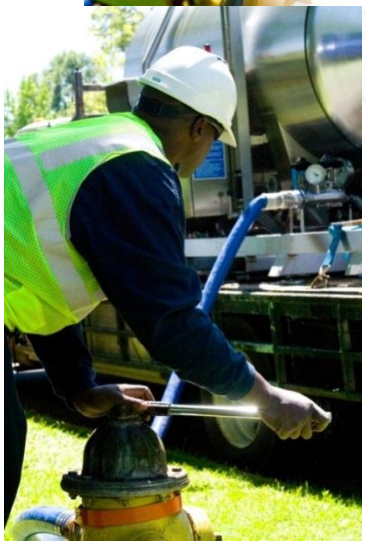
Water & WW Projects all across the U.S.

- Perry, GA
- Destin, FL
- Smyrna, DE
- Keene, NH
- Middlebury, VT
- Crystal City, MO
- Stokes County, NC
- Alfred, ME
- Jackson, MI
- Tilton, NH



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WHEN to use Ice Pigging?

- ✓ **Customer complaints – "dirty water"**
- ✓ **Dead ends and low use – water age & buildup**
- ✓ **Low Flows – Fe, Mn, organic matter, sediment, sludge, oils & greases…**
- ✓ **Losing residual**
- ✓ **Impaired Water Quality – turbidity, color, odor, Fe, Mn, BIOFILM, Bacteria hits (TCR)…**
- ✓ **Raw water lines**
- ✓ **Wastewater – force mains and siphons**

Questions?

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Contact Information:

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603-724-8226

Middlebury Sewer Forcemain

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Plan

- ✓ Engineers at A+E worked with the Town of Middlebury and Utility Service Group to create a schedule and plan for the ice pigging insertion points.
- ✓ The number and location of insertion points (9) 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 existing air release /cleanout manholes for insertion points (7 of the 9) saved money.

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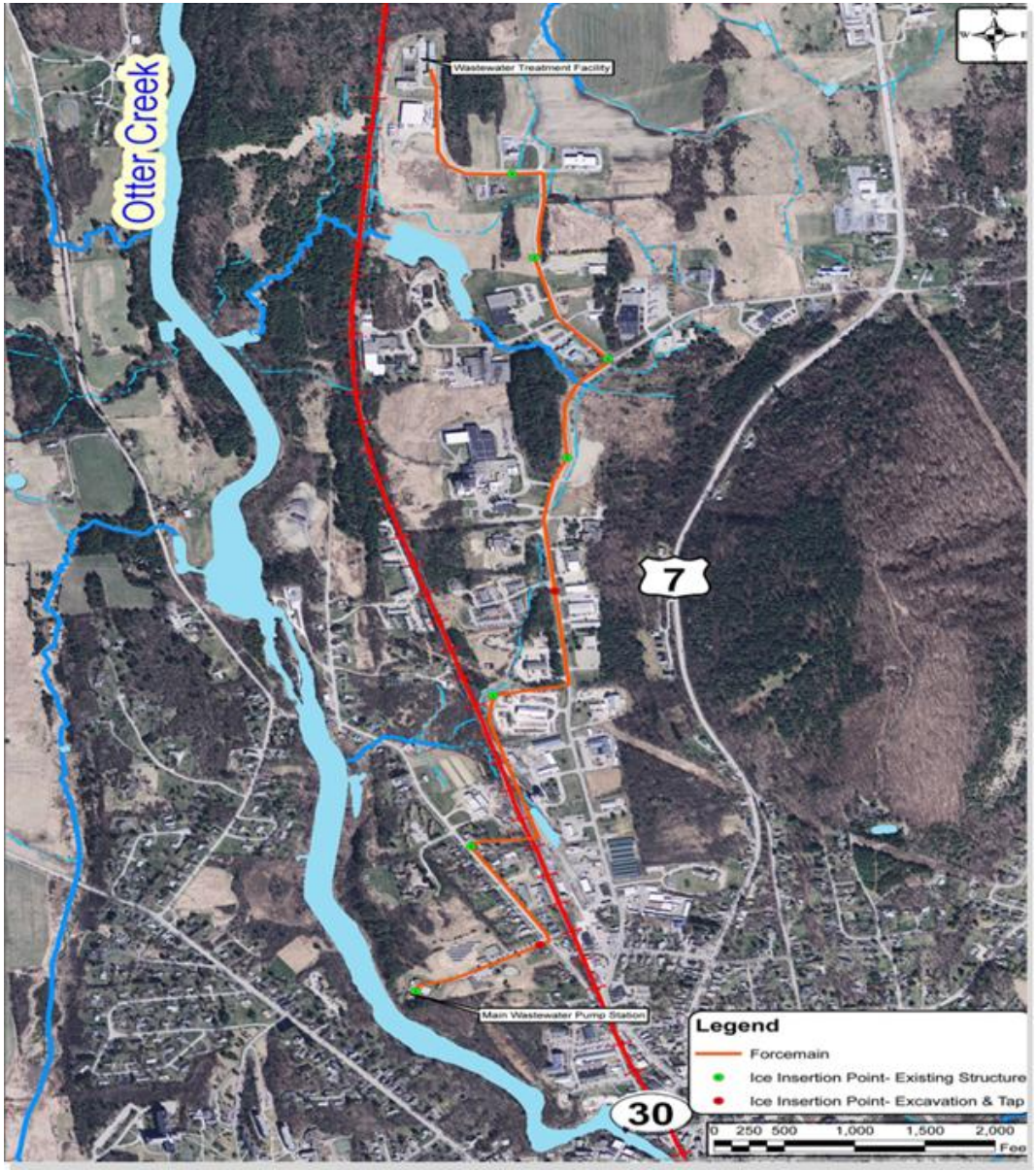

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Ice Pigging Schedule

ICE PIGGING

Ice Pigging Schedule

Client	Middlebury Public Works	Location	Middlebury VT	USC Salesman	S. Kelley

Date	Op No.	Insertion Point	Discharge Point	Disposal Method	Length (FT)	Pipe Dia. (in)	Pipe Material	Ice Quantity (Gals)	Delivery Rig	Volume Needed (Gallons)	Height needed in Large Wet Well Using Both Wet Wells (Feet)	Pumping Time Needed @ 2,500 gpm (3.6 mgd) (1 pump High Speed) (Minutes)
7-Oct	Run 01	ARV2	Grit Removal	N/A	1345	18	PVC	2700	10T	17,807	0.6	7
9-Oct	Run 02	ARV3	N/A	N/A	1170	18	PVC	2700	10T	33,298	1.1	13
11-Oct	Run 03	ARV4	N/A	N/A	1130	18	PVC	2700	10T	48,258	1.5	19
16-Oct	Run 04	ARV5	N/A	N/A	1555	18	PVC	2700	10T	68,846	2.2	28
18-Oct	Run 05	New Blow off-TBD	N/A	N/A	1270	18	PVC	2700	10T	85,660	2.7	34
21-Oct	Run 06	ARV6	N/A	N/A	1500	18	PVC	2700	10T	105,520	3.3	42
23-Oct	Run 07	ARV7	N/A	N/A	1391	18	PVC	2700	10T	123,936	3.9	50
25-Oct	Run 08	New Blow off -TBD	N/A	N/A	1312	18	PVC	2700	10T	141,306	4.5	57
28-Oct	Run 09	Pump Station	N/A	N/A	1100	16 & 18	DIP	2700	10T	155,870	4.9	62

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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.

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Sharing the Experience

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 ice pigging process.

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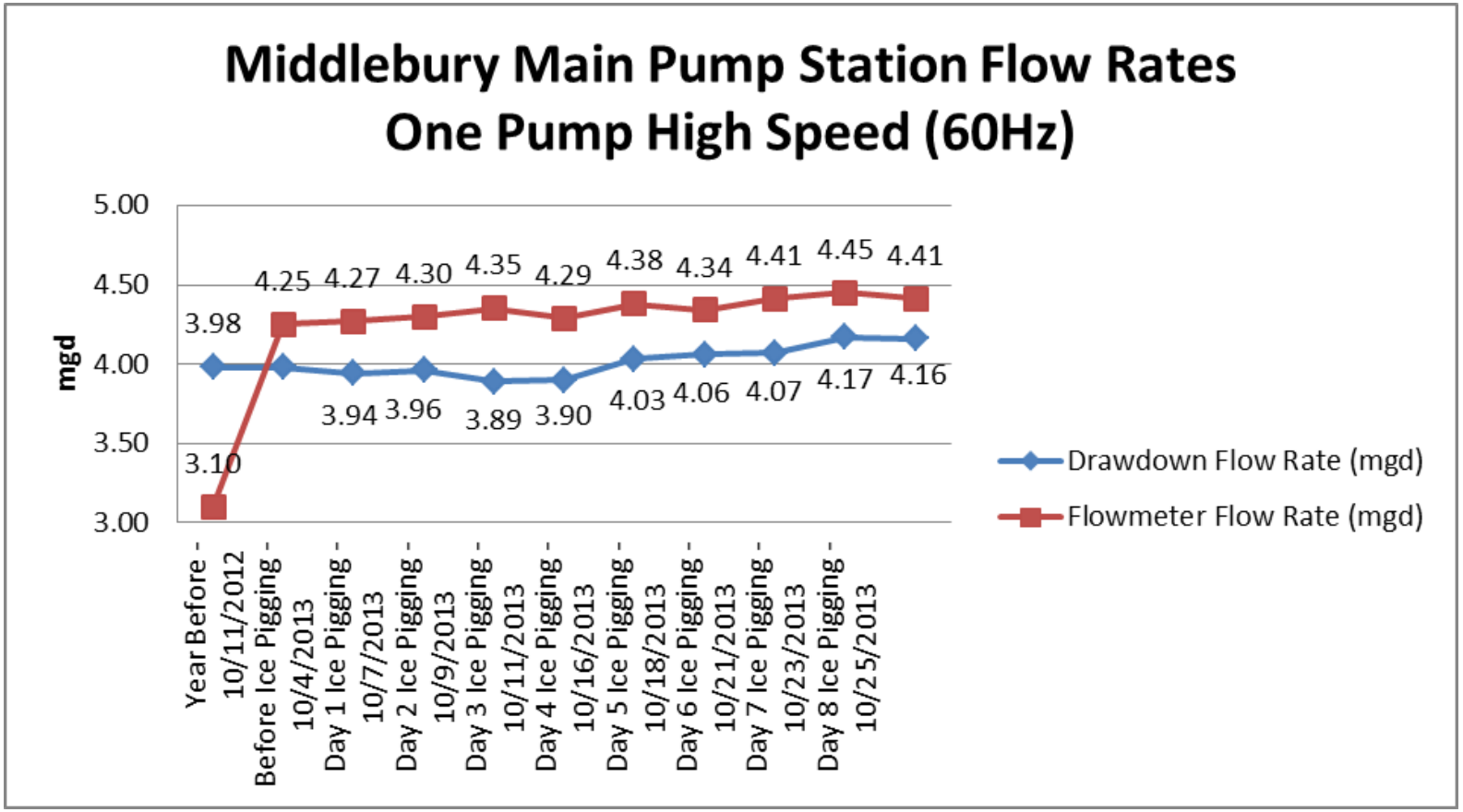
Daily Monitoring

- ✓ Ice inserted every other day with ice manufactured on off day.
- ✓ Pumping capacity checked with same pumps (1 and 2) via drawdown testing after each cleaning to document results.
- ✓ Town had an out clause in contract if a measureable improvement was not being observed.

Flow Rate Changes – 1 Pump



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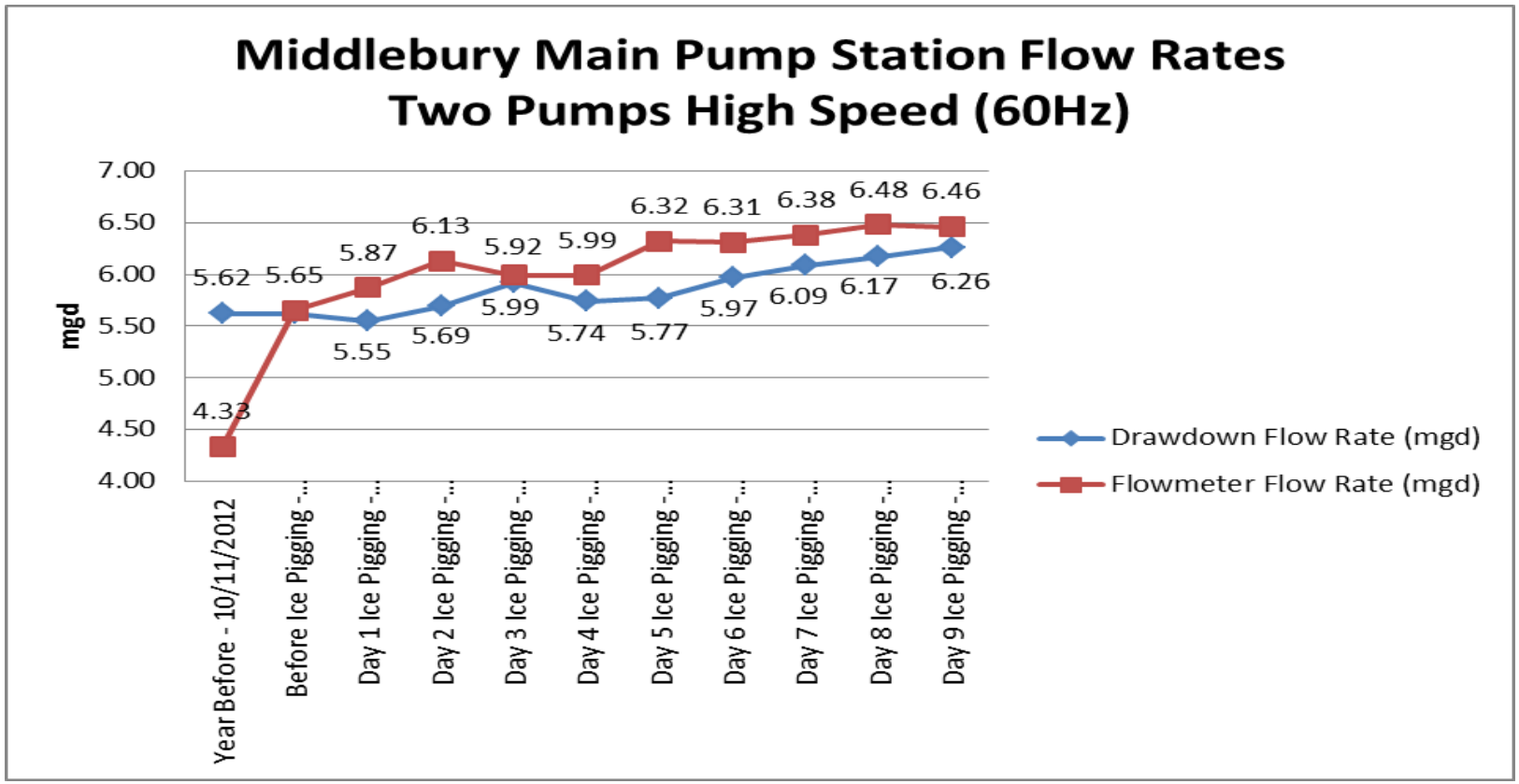
Flow Rate Changes – 2 Pumps



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Results

- ✓ Ice pigging successfully cleaned the force main and pump rates returned to about 6.2 mgd.
- ✓ 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, saving energy, and wear.
- ✓ The pump station now operates at full capacity, saving energy and eliminating CSOs, protecting public health and the environment.
- ✓ The project was completed on schedule and within budget with no field changes or change orders!

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Lessons Learned & Outcomes

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Lessons Learned

- ✓ “Industry standard” solid poly pigging ruled out due to pipe size changes, bends, wyes, and no insert or retrieval stations.
- ✓ Simplicity of ice pigging.
- ✓ Town’s role and staff responsibility.
- ✓ Overcame Middlebury’s higher than normal wastewater temperature which made this technique challenging.
- ✓ Pumping control and programming change implemented developed to achieve scour velocity and satisfy owner’s desire for continuous flow.
- ✓ New, effective, and affordable pipe cleaning technology has been demonstrated for sewer forcemains in US.

Innovation

- ✓ This was the first use of ice pigging techniques to clean sewer force mains larger than 8” diameter in North America.
- ✓ This project was the longest continuous run of sewer force main (12,000 LF) ever cleaned by ice pigging in North America!
- ✓ Proves large diameter force mains can be cost-effectively and successfully cleaned by ice pigging.

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Q&A

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