

BREWSTER'S MANGANESE REMOVAL PROJECT

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Lee Webster, Brewster Public Works Director
Misty Ruiz, Brewster Finance Director/City Clerk



THE
LANGDON
GROUP



GATEWAY
MAPPING
INC.

OTHER J-U-B COMPANIES

Overview



- Orientation to Brewster
- Project Background
- Manganese
- System Improvements
 - Well Development
 - Pipe Replacement
 - Ice Pigging
- Funding

Brewster, Washington



Background

- Water System
 - 753 physical connections
 - Three supply wells
 - Two wells are Mn producing and in emergency status
 - Four storage tanks in two pressure zones
 - Lower Zone
 - 300,000 gal – Constructed in 2017
 - 300,000 gal – Constructed in 1963
 - Upper Zone
 - 500,000 gal – Rehabbed in 2017
 - 500,000 gal – Constructed in 2017
 - One booster pump station

Background



Background

- Comprehensive Water System Plan in 2013
 - Documented 2008 tank inspection identifying leaks and potential voids under slab
 - Recommended repairing cracks and voids in 500,000 gal tank
 - Recommended lining lower tanks
- No real motivator for additional storage
- Planned to move forward with project to address Mn



Post Fire Observations

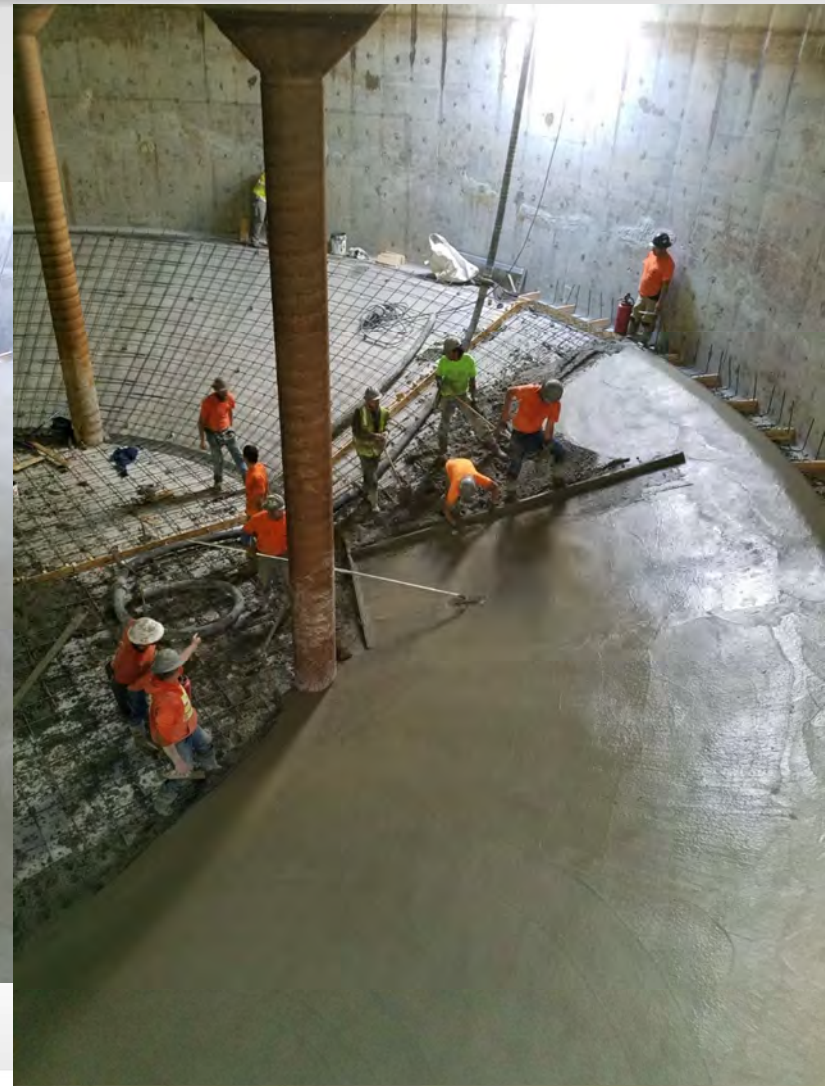
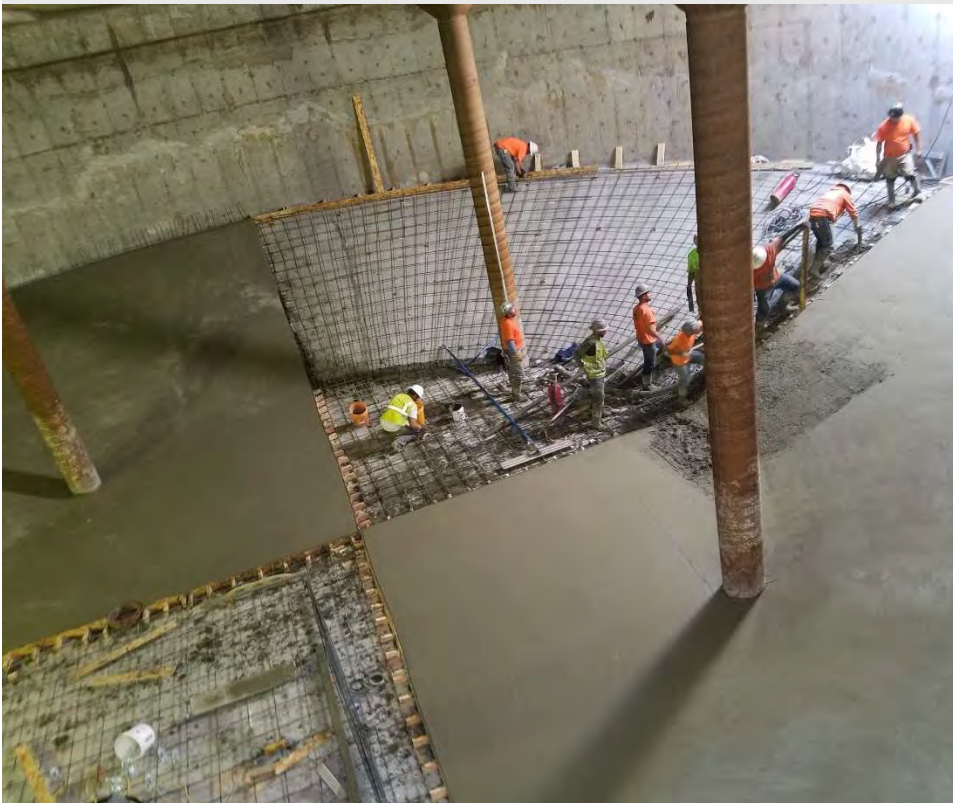
- Experiencing losses of 115,000 gpd
- Tank Inspection and Repair
 - Evaluate condition post fire storm condition August 2014
 - “Live” repairs were made
- Losses reduced to under 60,000 gpd



Construction – New Tanks



Rehab of Existing Tank



Refocus on Manganese

- Began reviewing Alternatives in 2015



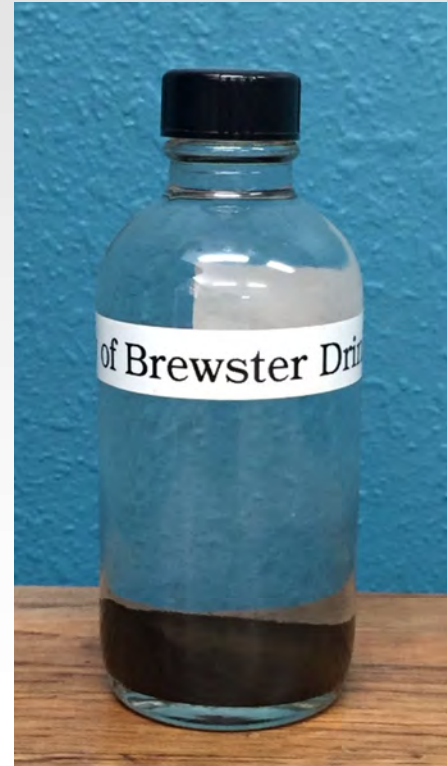
Manganese

- Brewster's two River Wells
 - Increasing concentrations of manganese over 20 years
- Manganese oxidation
 - Black deposits in service lines
 - Black sludge in storage tanks

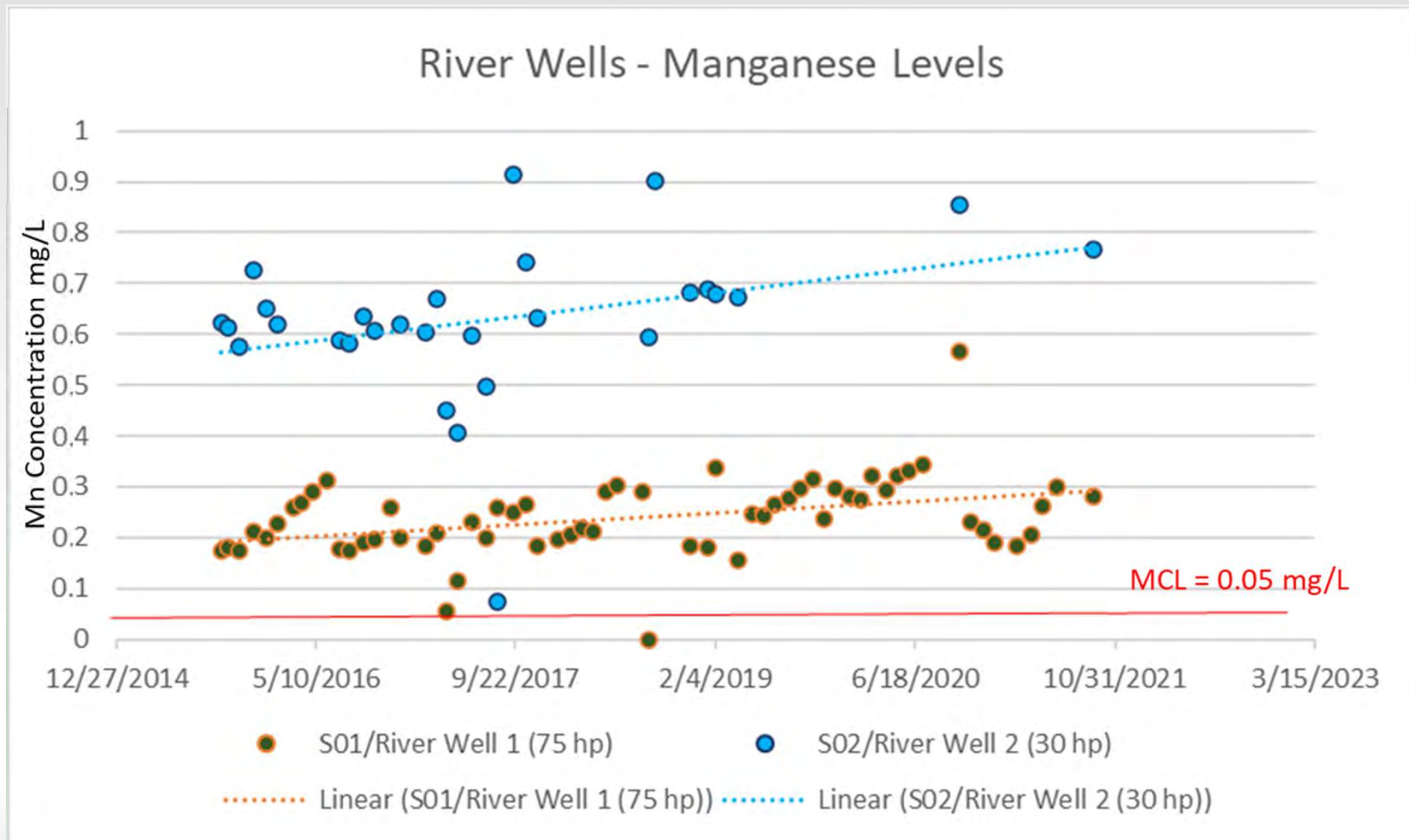


Manganese Regulations

- Currently Secondary Contaminant
 - 0.05 mg/L
 - Aesthetics
- Moving toward Primary Constituent
 - Public health protection



River Wells



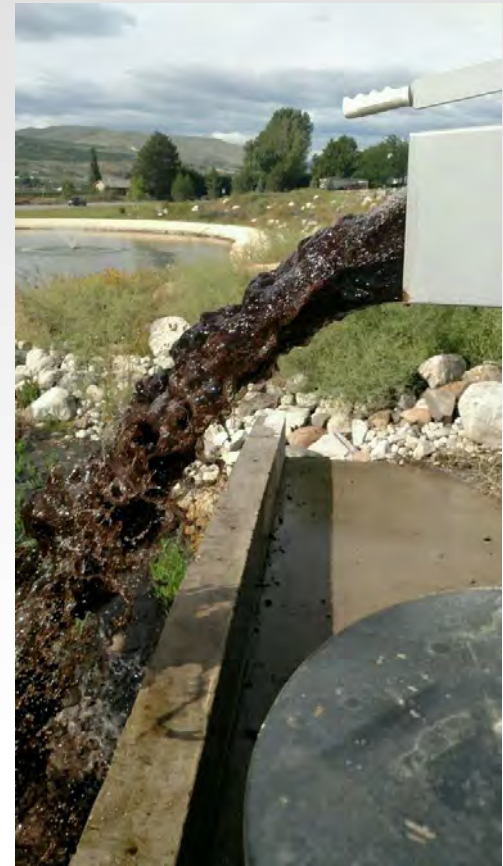
Manganese



Clogged Line



2-inch Water Meter



Hydrant Flushing

System Mn



Commercial Impacts



Alternatives

- Treatment of River Wells to remove Mn
 - Pressurized greensand filter
 - Relatively high costs
 - Ongoing O&M
 - Additional environmental and certificate requirements
- Surface Water Treatment
 - High Costs
 - Additional facilities
- ✓ New Ground Water Supply
 - Lowest long-term costs
- ✓ Other Project Components
 - Distribution line replacement
 - Distribution cleaning



Project Need

City of Brewster: Water System Manganese Contamination

PROJECT NEED

Two of the City of Brewster's three water supply wells are contaminated with manganese levels between **6 and 12 times the state recommended limit**. This metal plugs water lines with black slime, which eventually causes black water to come out of taps, and has been linked to chronic health problems, including hyperactivity, impaired intellect, and reduced memory and motor function. **Children and the elderly are most impacted by manganese toxicity.**

Besides the public health impacts, the manganese contamination **affects local businesses**, especially those that require a clean water supply like restaurants and fruit packing houses (a \$600 million per year industry.) "The City of Brewster's high manganese levels in their water has a definite effect on our production schedules. It also adds costs by increasing water usage when black water events happen, because we have to drain and refill process water tanks. This will also increase long-term costs because the process puts stress on our electric valving, piping and sensors," said Tory Wulf of Gebbers Farms.

This problem appeared about 15 years ago and has gotten worse each year. The silver lining is that the City has one well without manganese. Although it is not enough to supply the City, it does mean that the City can drill additional wells to solve the problem.

SOLUTION AND COST

The recommended solution for this problem is to drill two new wells, connect them to the system, and clean the existing pipes that are full of black slime. **This project will cost approximately \$3.9 million.** "This is the City's top priority, but since most of our residents are low to moderate income, our ratepayers don't have the means to pay. We must find grants to help pay for the work," said Lee Webster, Public Works Director.

PROJECT COST	
New water supply	\$3.6 million
System cleaning	\$0.3 million
Project Total	\$3.9 million

January 2017



Black water from a fire hydrant



Black water from a packing house



Well manganese levels are much higher than the state's maximum contaminant level.



- Lots of advocacy to get things going!
 - Tech Teams,
 - Funding applications,
 - Meetings with legislators
- Ultimately an appropriation and a grant/loan package from USDA – RD

Well Location Challenges



- 26 locations researched
- 5 initial test well sites
 - Drilled test wells on 3
 - One viable option
- Sampled several existing wells
 - No viable alternatives
- 5 additional test well sites
 - 2 viable sites!

Evaluated Sites



New Production Wells

- Two New Wells Required
 - 3 Preferred Sites
 - Lower Reservoir Well
 - State Way Well
 - Canyon Well No.2



Lower Reservoir Well



- Located on City Property
- Some Challenges and Benefits
 - Challenges
 - Above existing reservoirs – pumping down hill
 - Benefits
 - High water quality
 - High quantity of water
 - City owned property



State Way Well



- Test well
 - High water quality
 - Promising aquifer formation
- Production well
 - Much finer sediment
 - Low production flow
- Well was ultimately capped
- Additional development
 - Completed later and pending final results...

Canyon Well No.2

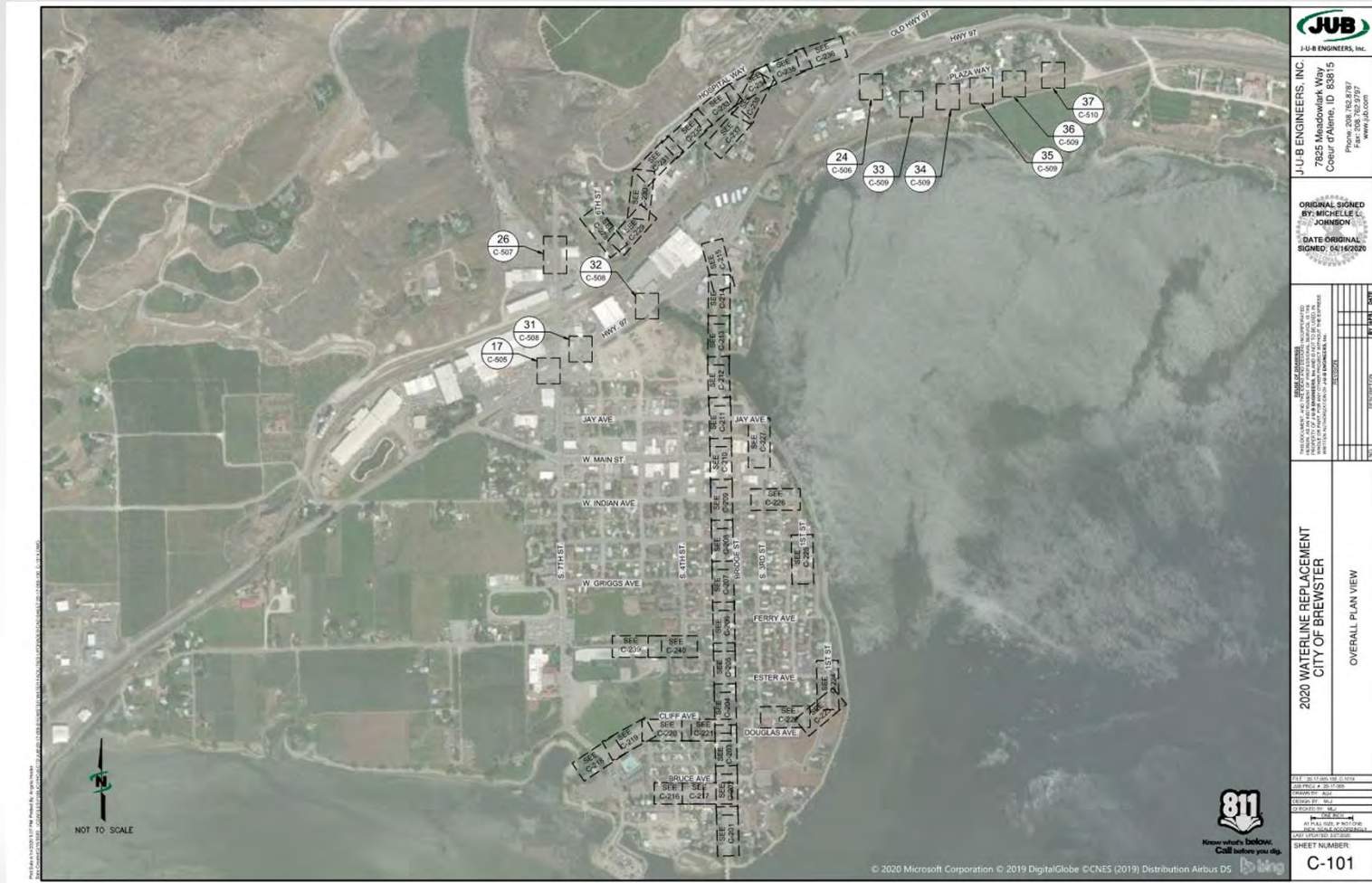
- Well House is under construction
 - Adjacent to an existing well
 - High quality water
 - High quantity
 - Minimal upgrades to connect to the system



Additional Improvements

- Waterline replacement
 - Upgrade undersized pipe
 - Improve looping
 - Abandon AC pipe where feasible
- Valve Addition
 - Improve system control
- Distribution Cleaning

Waterline Improvements



Existing Waterline Improvements

- Replaced more than 13,000 linear feet of pipe
- Almost 130 valves
- 20 fire hydrants



Pipe Cleaning Options

- Traditional Flushing
 - Requires high volume of water
 - Minimal control on flow direction
 - Velocity 1 to 3 ft/s
- Unidirectional Flushing
 - Requires high volume of water
 - Valve control for managing flow
 - Velocity 3 ft/s or higher
 - Flush smaller to larger mains

Pipe Cleaning Options

- Traditional Pigging
 - Not an option for most of the system
 - Long runs of pipe vary in size
 - Bridge Street 12" to 10" to 4" and back to 10"



Ice Pigging

- Ice Pig- a semisolid ice slurry that is pumped like a liquid through piping systems
 - Injected and recovered through hydrants
 - As temperature decreases the scouring increases
 - Ice temp is adjusted based on pipe material
 - i.e. AC pipe need more scrubbing that poly pipe
 - Temperature observed down to ~23 degrees F

Ice Pigging Cont.

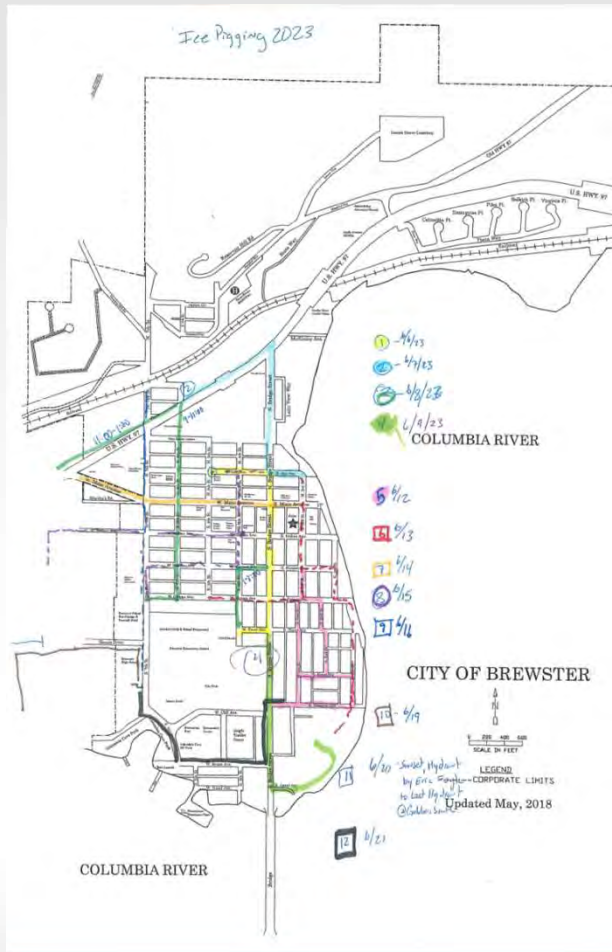
- Advantages
 - Flows through changes in diameter, bends and butterfly valves without blockage
 - No excavation
 - Minimal downtime for system
 - No required post cleaning disinfection

- Disadvantages
 - Broken Valves

Ice Pigging



Brewster Ice Pigging



Client: City of Brewster Location: Brewster, WA APS Rep: Paul Treloar
 APS Ref #: APS-IP-BB

Revision: 13-Jun-23 **Ice Pigging Schedule**

Date	Completed	Run Ref. Name/#	Insertion Point	Discharge Point	Disposal Method	Length (FT)	Pipe Dia. (in)	Pipe Material	Ice Quantity (Gals)
TUESDAY 6/6	<input checked="" type="checkbox"/>	DAY 1	27	28	SEWER/TANKER	3,000	8,12 & 6	AC	2,700
WEDNESDAY 6/7	<input checked="" type="checkbox"/>	DAY 2	7	10	SEWER/TANKER	3,900	12,10,6 & 8	AC	2,700
THURSDAY 6/8	<input checked="" type="checkbox"/>	DAY 3	3	12	SEWER/TANKER	2,700	12,6 & 8	AC	1,000
			7	8	SEWER/TANKER	1,400	12 & 10	AC	1,000
			25	26	SEWER/TANKER	2,000	6,8 & 12	AC	800
FRIDAY 6/9	<input checked="" type="checkbox"/>	DAY 4	28	27	SEWER/TANKER	2,900	12 & 8	AC	2,500
MONDAY 6/12	<input checked="" type="checkbox"/>	DAY 5	22	18	SEWER/TANKER	3,000	6 & 8	AC	1,200
			22	18	SEWER/TANKER	2,500	8,4 & 6	AC	1,000
TUESDAY 6/13	<input checked="" type="checkbox"/>	DAY 6	22	27	SEWER/TANKER	3,000	8,4 & 6	AC	1,200
			10	11	SEWER/TANKER	3,800	8 & 6	AC	1,300
WEDNESDAY 6/14	<input checked="" type="checkbox"/>	DAY 7	21	25	SEWER/TANKER	2,300	8,6 & 2	AC & GALV.	1,000
THURSDAY 6/15	<input checked="" type="checkbox"/>	DAY 8	24	25	SEWER/TANKER	2,200	6,8 & 10	AC	1,000
			27	35	SEWER/TANKER	4,600	6,8 & 2	AC	1,800
FRIDAY 6/16	<input checked="" type="checkbox"/>	DAY 9	1	31	SEWER/TANKER	4,000	10 & 8	AC	2,400
MONDAY 6/19	<input checked="" type="checkbox"/>	DAY 10	3	4	SEWER/TANKER	4,800	10	AC	2,700
TUESDAY 6/20	<input checked="" type="checkbox"/>	DAY 11	31	28	SEWER/TANKER	2,400	8 & 6	AC	900
			5	6	SEWER/TANKER	2,000	10 & 6	AC	1,000
WEDNESDAY 6/21	<input checked="" type="checkbox"/>	DAY 12	5	26	SEWER/TANKER	1,000	10 & 8	AC	600
			8	28	SEWER/TANKER	2,800	8,6 & 12	AC	1,100

Ice Pigging Process

- Pre flushing
- Ice pig injection
- Monitor discharge for conductivity and temperature
- Pumped to truck while the ice pig was moving through
- Post flushing



Brewster Ice Pigging



Hydrant Flushing



Right Before the Pig





System Mn



Ice Pigging Cost

Summary

- Success!
- ~ 31,000 LF of piping cleaned
- 5 days of cleaning
- Total Cost = \$230,000
- Cost for 13,000 LF of new pipe was \$3.3M

 	
Customer Questionnaire	
City/Utility/Entity:	City of Brewster, Washington
Contact Person:	Michelle Johnson, P.E./Dulci Kau Title: Project Engineer/ Project Designer, J-U-B Engineers
Billing Address:	
City:	Brewster County: Okanogan State: WA Zip:
Phone:	208-762-8787 Email: mjohanson@jub.com dkau@jub.com
Please attach GIS map or sketch of the main(s) showing scale, main size, pipe material plus hydrant and valve locations. For sewer force mains, please add pump performance data on a separate page	
General Project	
Main Designation	Potable Water <input checked="" type="checkbox"/> Raw Water <input type="checkbox"/> Sewer Force Main <input type="checkbox"/> Sewer Siphon <input type="checkbox"/> Leachate Main <input type="checkbox"/> Industrial/Other <input type="checkbox"/>
Length (FT)	Water Temp (°F) (if Potable or Raw) Water Source: Ground Surface <input type="checkbox"/> Other (please state) <input type="checkbox"/>
Diameter (in)	Static Pressure (psi) 60 to 95 Current Flow (gpm)* Desired Flow (gpm)
Pipe Material	Ductile Iron <input checked="" type="checkbox"/> AC <input checked="" type="checkbox"/> Steel (Lined) <input type="checkbox"/> Cast Iron (Lined) <input type="checkbox"/> PVC <input checked="" type="checkbox"/> HDPE <input type="checkbox"/> Steel (Unlined) <input type="checkbox"/> Cast Iron (Unlined) <input type="checkbox"/>
Site Location	Brewster, WA
Discharge of Sludge	Sanitary Sewer <input type="checkbox"/> Tanker <input checked="" type="checkbox"/> Is Discharge Permit Required? Yes <input type="checkbox"/> Ground <input type="checkbox"/> Other <input type="checkbox"/> No <input checked="" type="checkbox"/>
Note: Discharge should not be to ground unless State approval is provided Note: Permits must be provided by customer	
What is the reason for cleaning?	Significant manganese buildup.
What is your goal?	Removal of the manganese buildup.
Traffic Control Requirements	Flaggers <input checked="" type="checkbox"/> Road Closure <input type="checkbox"/> Police <input type="checkbox"/>
Should Prevailing Wage be considered?	No <input type="checkbox"/> Yes <input checked="" type="checkbox"/> Please provide details/rates
Please state any or all permit or contractual requirements, required of American Pipeline Solutions:	
Spring of 2023	
Project Timeframe:	Spring of 2023 Preferred Time of Cleaning: Daytime <input checked="" type="checkbox"/> Night <input type="checkbox"/>
Any other considerations?: The attached map include Brewster's waterline backbones, but the City is interested in doing as much cleaning as they can.	
Please note, for optimum performance, a minimum velocity of 0.56ft/s is desired	
Please return completed form to: Paul Treloar - paul@americapipe.com	
www.americapipelinesolutions.com/ice-pigging	

Project Costs

Manganese Removal Project	% of total	Cost
Soft Costs	2.3%	\$265,916
Engineering Design and CMS	20.2%	\$2,365,759
Archeological Monitoring	0.4%	\$50,000
Well Drilling (Test Wells and Production)	6.1%	\$714,900
Well Houses and Piping	37.0%	\$4,339,042
Waterline Improvements	28.1%	\$3,299,519
Misc. Site Prep, Materials, Meters	2.8%	\$328,980
Ice Pigging	2.0%	\$230,759
Valve Replacement	1.2%	\$142,875
Total Allocated		\$11,737,750

Project Funding

	Loan	Grant	Total
Water Reservoir Replacement 2015			
FEMA		\$0	\$349,161
CDBG		\$0	\$1,000,000
Direct Appropriation		\$0	\$1,250,000
Department of Health Forgiveness		\$376,500	\$376,500
			\$3,352,161
Manganese 2017			
USDA-RD		\$2,631,000	\$6,300,000
USDA-RD Subsequent Funding		\$480,600	\$1,666,400
Direct Appropriation		\$0	\$752,000
Direct Appropriation-Well Houses 202			\$494,400
			\$12,324,400
	\$200,000.00 City Match		

■ Funding Package

- State Appropriation – Thank you!
- USDA Rural Development – Grant Loan Package – Thank you!
- Department of Health – Thank you!
- Rate Payers – Thank you!

How We Got Things Done

- Put together the right team
- Staff that is willing to put in the work
- Having a mayor and council on board
- Develop a gameplan and focus on that
- Build on each small success

Project Success



Questions?

- Michelle Johnson - mjohnson@jub.com
- Lee Webster – lee.webster@brewsterwa.us
- Misty Ruiz – misty.ruiz@brewsterwa.us
- Rick Rose – Richard.rose@usda.gov