Water quality update for the Millville Elementary School

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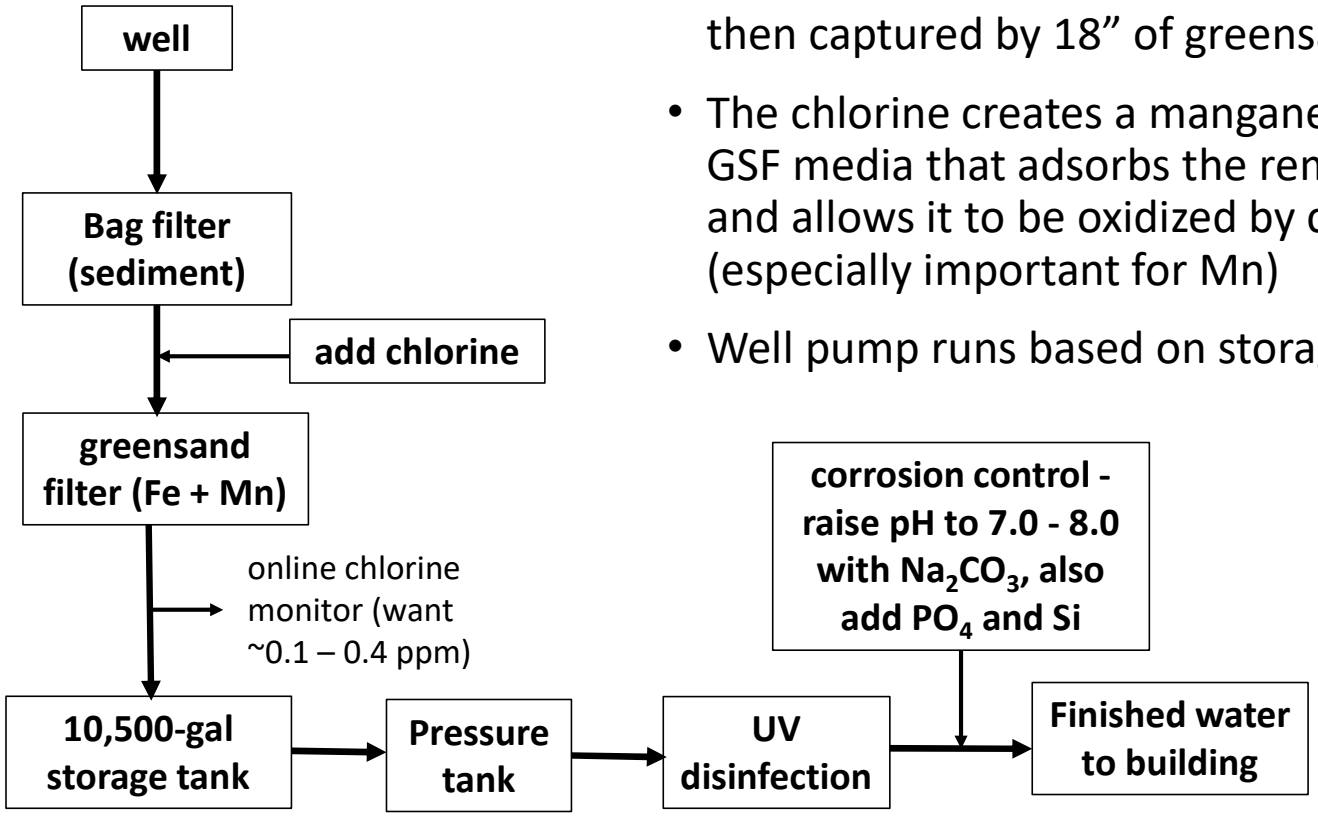
Present status at Millville

- Fe/Mn removal excellent
- HAA5 and TTHM levels good
- Nov. + Dec. had high Fe + TOC, yet very good Fe, Mn, and DBP results
- Water demand is very low
- Planning to install automation to prevent chlorine residuals from getting too high even without operator attention
- Thank you to Scott, Matt and Denise at MES for their help
- Had one day of color in GSF effluent in Oct.; cause identified and promptly brought under control
- Changed greensand filter strategy in Oct. and stopped creating much demand; just let the system run as needed and not too much at once
- McClure Engineering started to provide treatment plant assistance 12/7/23

Millville Water Treatment System



- Chlorine oxidizes most dissolved Fe + some Mn which is then captured by 18” of greensand filter (GSF) media
- The chlorine creates a manganese dioxide coating on the GSF media that adsorbs the remaining dissolved Fe/Mn and allows it to be oxidized by chlorine over time (especially important for Mn)
- Well pump runs based on storage tank levels (at ~6 gpm)
- Chlorine in GSF effluent is monitored continuously. Normally desire a chlorine residual of 0.5 to 1.0 ppm, but lower levels are used at MES to minimize DBPs
- Want [Mn] ≤ 0.015 ppm

Treated water quality is typically good

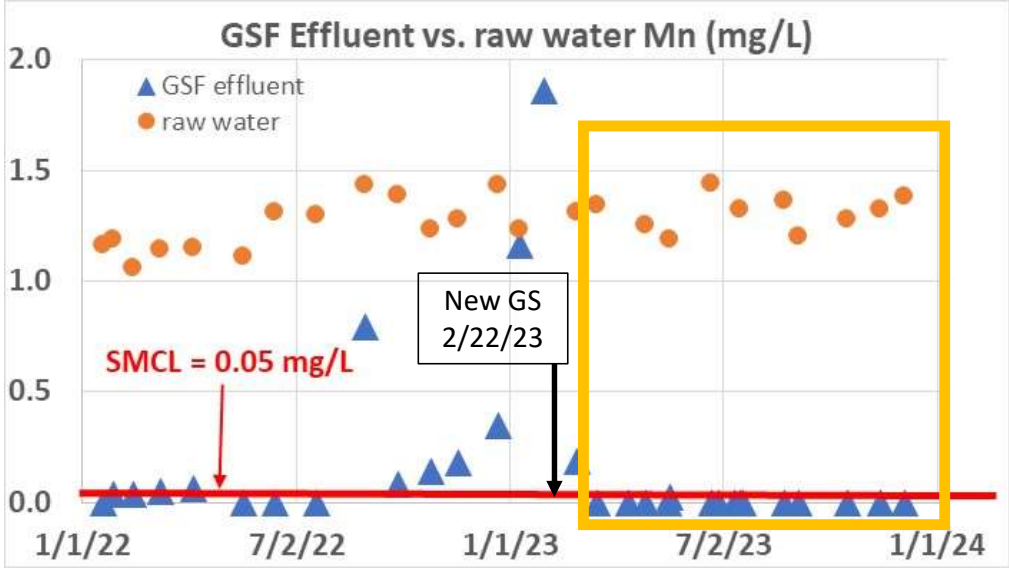
- **Good Water Quality:** Overall, the quality of the treated water at MES is quite good and currently meets all of the state and federal regulatory requirements with the exception of haloacetic acids (HAA5) and total trihalomethanes (TTHM)
- Also had color issues from manganese occasionally in recent years

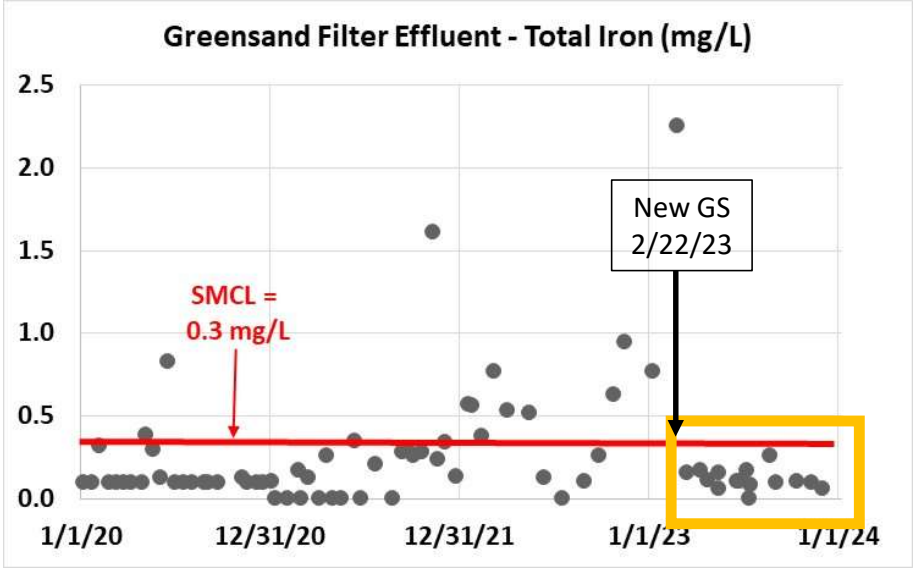
❖ **The MES water meets all regulatory requirements for the following important water quality parameters:**

- ✓ Bacteria and other microorganisms
- ✓ Lead and copper
- ✓ Synthetic organic chemicals (SOCs)
- ✓ Volatile organic chemicals (VOCs)
- ✓ Heavy metals (mercury, cadmium, etc.)
- ✓ Per- and polyfluoroalkyl substances (PFAS)
- ✓ Radiological substances
- ✓ Nitrate and nitrite
- ✓ Pesticides (insecticides, herbicides, rodenticides)
- ✓ Algae and algal toxins
- ✓ Taste and odor

Manganese and Iron (GreensandPlus filtration)

11/13/23 raw water had 30 ppm iron and 17 ppm TOC, outrageously high values!

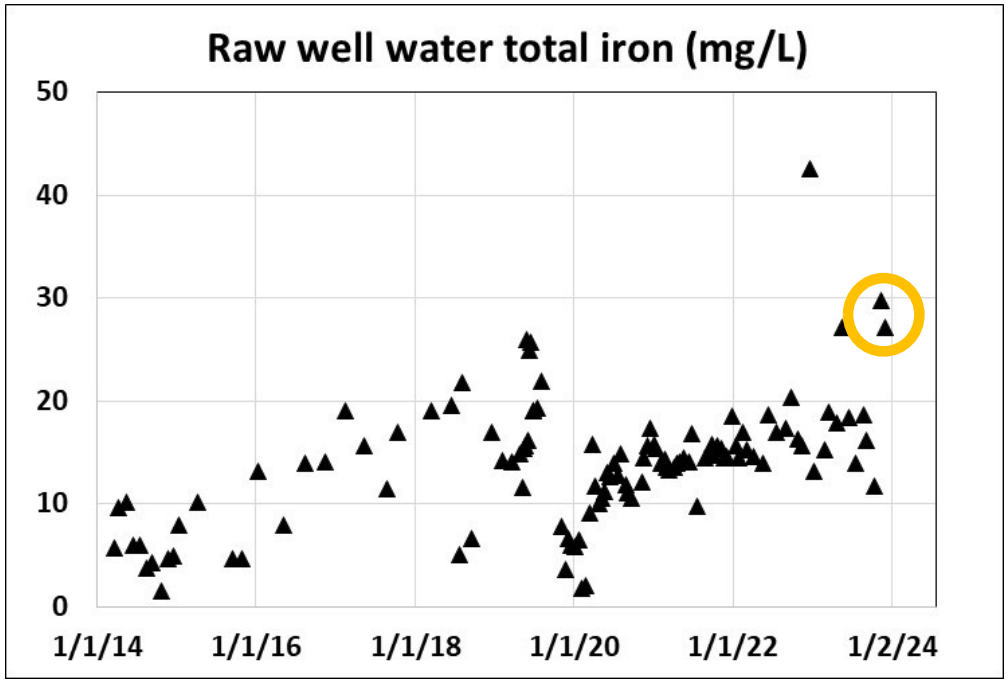




- *14 of 15 samples for Mn since Mar. 2023 have been non-detect (< 0.02 mg/L), including all since June*

- *All 15 iron samples since March 2023 have been below the SMCL of 0.3 mg/L*

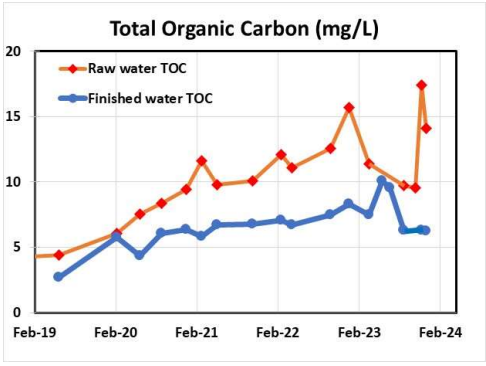
Iron removal



Date	Total Fe (mg/L)	
	Raw Well Water	Greensand filter effluent
8/24/23	19	0.26
9/5/23	16	0.10
10/16/23	12	0.11
11/13/23	30*	0.10
12/4/23	27*	0.061^

** 2nd + 3rd highest values in 10 years*

^ avg value, one GSF was nondetect



- 11/13/23 TOC = 17.4 mg/L
- Must be no colloids formed

Haloacetic acids (HAAs)

	HAA5 (ppb)	
2023	DBP-1	DBP-2
Jan	23	
Feb	249	
Mar	110	115
Apr	126	
May	46	44
Jun	140	
Jul	22	
Aug	31	43
Sep	18	
Oct	41	
Nov	42	42
Dec	20	

- *HAA5 violations in recent years resulted in Public Notices*
- *Compliance sample results in July – December all good for HAA5, averaging 30 ppb*
- *MCL= 60 ppb, based on Locational Running Annual Average (LRAA)*
- *MCL is based on consuming 2 liters (~ ½ gallon) each day for 70 years*
- *Site DBP-1 is the bathroom next to room 111, and DBP-2 is Room 322*

Total Trihalomethanes (TTHMs)

	TTHM (ppb)	
2023	DBP-1	DBP-2
Jan	14	
Feb	158	
Mar	115	113
Apr	109	
May	95	93
Jun	76	
Jul	161	
Aug	97	91
Sep	113	
Oct	57	
Nov	56	60
Dec	36	

- *Compliance sample results were better in October thru December, averaging 50 ppb (72 ppb average for August thru December)*
- *MCL= 80 ppb, based on Locational Running Annual Average (LRAA)*
- *Site DBP-1 is the bathroom next to Room 111, and DBP-2 is Room 322*

Regulatory Compliance

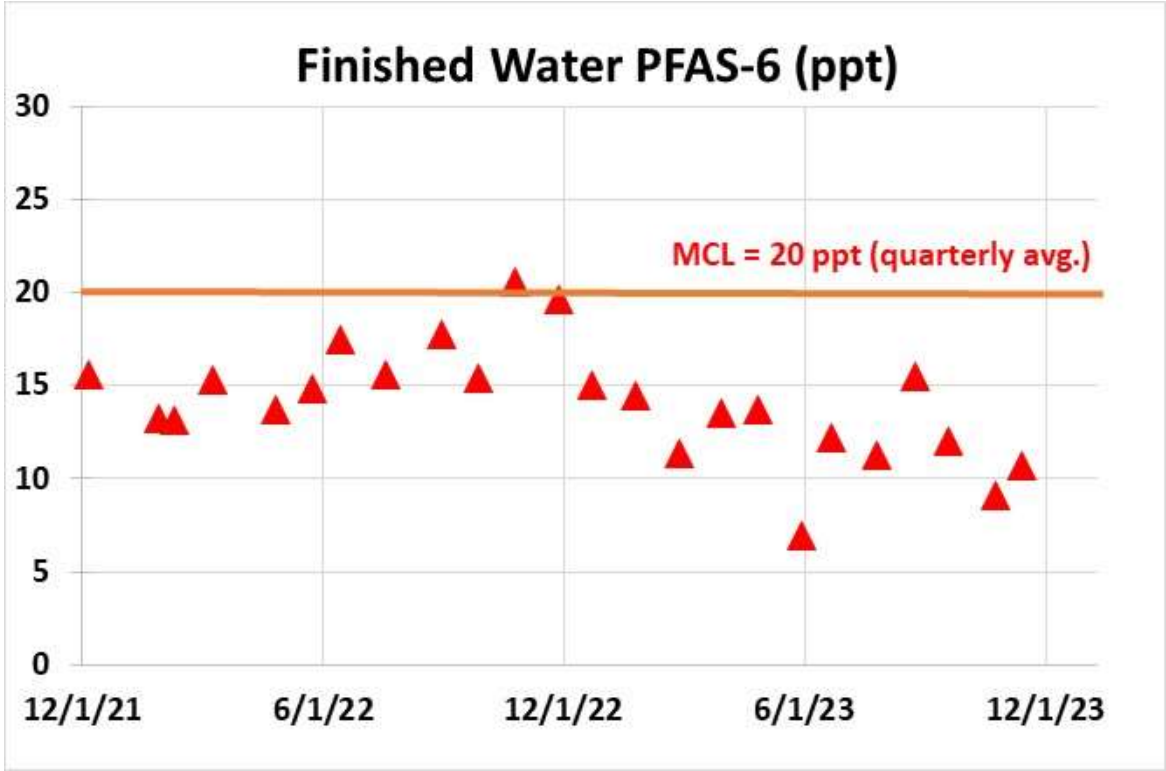
- 2023 Quarter 4 will have MCL violations and a Public Notice for excessive HAA5 + TTHM due to the annual averaging for compliance
- 2023 Quarter 4 did NOT exceed the OEL (Operational Evaluation Level) for either HAA5 or TTHM at either site DBP1 or DBP2
- Average HAA5 and TTHM for August (when the new operations team started) thru December are below the LRAA MCLs

Results from 4th Quarter vs. results needed in 1st Quarter to meet the four MCL possibilities for the DBPs

all µg/L	Q4 HAA5 result	Need for Q1 HAA5		Q4 TTHM result	Need for Q1 TTHM
DBP1	34	≤ 73		50	≤ 57*
DBP2	42	≤ 110		60	≤ 77

** Affected by 160 ppb result for July 2023; without that would only need ≤ 77 ppb TTHM for DBP1*

PFAS-6



- PFAS = per- and polyfluoroalkyl substances
- 24 samples with no MCL exceedance
- Last 12 months averaged 12.2 ppt with maximum 15.0 ppt
- Likely future MCL for individual compounds and that would require treatment

Potential Future Alternatives

- ❑ **Aeration** in storage tank to remove THMs
- ❑ **Activated carbon** for PFAS, TOC, and HAAs + THMs
- ❑ **Permanganate** to replace chlorine as the oxidant for iron and manganese removal via greensand (to eliminate formation of HAAs + THMs)
- ❑ **Ion exchange** to remove PFAS
- ❑ **Connection to Uxbridge water system** being explored, but their water currently also has some PFAS