



SECONDARY WATER QUALITY TREATMENT SYSTEM REQUEST

Foxboro Estates Wells #3
 NC 03-68-144
 WSF ID No: P03
 AQUA NORTH CAROLINA, INC.

A. EXECUTIVE SUMMARY

The Foxboro Estates Master Water System is comprised of 2 active wells and 2 separate points of entry (POE). **The latest combined concentrations of Fe and Mn at both wells are over 1 mg/L, which makes both wells part of Aqua's Group 1 Priority Secondary Water Quality Projects as per the Water Quality Plan.** Well #2 is currently kept in operational backup mode due to the poor water quality and low well production. The system's demand is currently met only with well #3.

Well #3 was drilled within 40 feet of Well #1 as an emergency water supply well by Heater Utilities due to production loss. Well #1 has since been abandoned.

Based on studies performed by AWWA and other organizations, elevated concentrations of Mn are being linked to cause adverse health effects. Preliminary engineering studies indicate that Manganese Dioxide filtration is the most effective and permanent solution since it physically removes Fe and Mn.

Aqua proposes installing an oxidation-filtration system at Foxboro Estates Well #3 in order to remove Fe/Mn below the sMCLs and continue to keep well #2 in operational backup mode to provide emergency water supply as needed.

Installing an interconnect with a local municipality to supply system demand with purchased water (PW) in lieu of filtration is not a feasible alternative given there are no local municipalities in the vicinity. See vicinity map.

Capex and Opex estimates for filtration are given below in Section D.2.

PROPOSED SYSTEM REQUIRING TREATMENT

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|---|--------------------------------|
| 1. System Name: | <u>Foxboro Estates Well #3</u> |
| 2. PWS ID: | <u>NC 03-68-144</u> |
| 3. No. Active Residential Connections, as of July 2021: | <u>19</u> |
| 4. No. Permitted Residential Connections: | <u>19</u> |
| 5. List of DEH/PWSS Approved Wells and Storage | |

TABLE 1: Approved and Active Wells in Proposed System

Well Name and No.	Past 12 Month Average		Latest POE Inorganic Sampling Results				
	Well Production (GPM)	Runtime (hrs./day)	Fe (mg/L)*	Mn (mg/L)	Fe/Mn Loading Rate (lbs./day)**	Fe/Mn Loading Rate (lbs./yr.)	Average Fe/Mn Loading Rate Per Residential Customer (lbs./yr.)
Well #2	0	0	1.37	0.288	0.1	22	1.2
Well #3	23	2	1.78	0.759	0.2	84	4.4

*Raw samples are taken directly at the wellhead before chemical treatment and point of entry (POE) samples are taken after chemical injection and treatment but before the tank and distribution system

**Loading rates are normalized based on a 12-hour per day well runtime.

TABLE 2: Existing Storage at Well Sites

Well Name and No.	Storage Description		Most Recent Cleaning Date
	Type	Gallons	Dist. System
Well #2	N/A	N/A	Mar. 2020
Well #3	Hydro	5,000	Mar. 2020

6. Past Three (3) Years Flushing Occurrences, list month/year:

Response: May 2017, Jan. 2020, Mar. 2020.

7. Next Planned Distribution System Flushing Occurrence:

Response: This water system will be flushed again Dec. 2021 and on an ongoing annual basis.
 Disclaimer: Flushing does not completely remove the mineral accumulation in the distribution mains when utilizing water with exceptionally high levels of iron and manganese in the source water.

8. List of chemicals being used:

TABLE 3: Existing Chemicals Used at Well Site

Well Name and No.	State Approved Treatment			
	Disinfectant	Caustic	Sequestrant	Fe/Mn Filter
Well #2	X	X	X	N/A

Well #3	X	N/A	X	N/A
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9. Current description of the water treatment system for each well over the past three (3) years, including specific names of chemicals and dates of changes:

Response: Started feeding Seaquest at both wells Aug. 2015. No cartridge filters currently installed at either well.

10. Planned changes (if any) for chemical treatment within the next six (6) months:

Response: None.

11. Comments on Approved/Current Well Capacity.

Response: There has been no significant deviation of the well production from the approved pumping capacity for well #3.

B. CURRENT SECONDARY WATER QUALITY CONCERNS

- How many wells require treatment? 1
- Can system operate with single well offline? Yes, well #2 offline*

* Well #2 is currently kept in operational backup mode due to the poor water quality and low well production. The system's demand is currently met only with well #3.

- Are combined Fe/Mn concentrations above 1 mg/L? Yes
- Date of most recent POE Fe/Mn sampling results 8/18/2021

TABLE 4: Past 3 Years Fe/Mn Analysis

Foxboro Estates Well #2 Laboratory Analysis at POE						
Date	Iron (Fe), mg/L			Manganese (Mn), mg/L		
	Tot.	Sol.	Insol.	Tot.	Sol.	Insol.
1/6/2016	ND	-	-	ND	-	-
2/6/2019	0.136	-	-	0.0107	-	-
2/26/2019	13.2	0.0263	13.1737	0.328	0.289	0.039
3/19/2020	7.26	0.022	7.238	0.198	0.198	0.00
8/6/2020	1.37	0.094	1.276	0.288	0.283	0.005
8/18/2021	27.8	-	27.8	0.399	0.371	0.028
Foxboro Estates Well #3 Laboratory Analysis at POE						
Date	Iron (Fe), mg/L			Manganese (Mn), mg/L		

	Tot.	Sol.	Insol.	Tot.	Sol.	Insol.
1/6/2016	2.01	-	-	0.346	-	-
2/26/2019	0.739	-	-	0.706	-	-
3/19/2020	0.905	0.0344	0.8706	0.467	0.458	0.009
8/6/2020	2.29	0.064	2.226	0.477	0.457	0.02
8/19/2020	1.78	0.128	1.652	0.759	0.717	0.042
8/18/2021	1.98	-	1.98	0.470	0.347	0.123

- Describe previous actions to improve secondary water quality and describe results (i.e., installation of particulate filters and sequestering agents).

Response: Aqua is flushing the distribution system annually and feeding Seaquest. The intent of the sequestering agent is to physically chelate or hold Fe and Mn in a soluble state, ideally decreasing the insoluble concentration and resolving water discoloration issues. Because Fe usually reaches the surface in mostly an insoluble state, it is very challenging to convert insoluble Fe back into a soluble state unless the chemical dose of the sequestering agent is increased heavily. Also, sufficiently long contact time is a necessary criterion to make this happen. Because sequestering does not physically remove Mn, Aqua is concerned that its efforts to reduce total Mn will not be effective without adding a Fe/Mn treatment system or equivalent treatment system such as a those using solid phase Manganese Dioxide.

D. UTILITY COMMISSION REQUIRED INFORMATION

- Well Location Map Attached
- DEH/PWS Approval Letter Attached
- Original 24 hr. Pump Status Report Attached
- Past 36 months of pump status reports Attached
- Inorganic Analysis Report submitted to DEH for well approval Attached
- Past 6 yrs. inorganic analysis from each wellhead Attached
- Past 3 yrs. Fe/Mn analyses, both soluble and insoluble. See Table 4 Above

Note: For item (6) above, provide information on baseline (w/o treatment – raw samples taken at the well head) and point of entry (after treatment).

E. CUSTOMER COMPLAINT DATA

- Total number of customer complaints in past 6 months 0
- Total number of customer complaints in past 12 months 0
- For past 6 months, do customer secondary water complaints exceed 10% of the number of active customers? No
- Provide 12-month list of all water quality complaints N/A

5. Provide 12-month list of all completed water quality work orders _____ N/A
6. Describe most common customer complaint over the past 12-month period relating to secondary water quality, i.e., discolored water, taste, or odor.

Response: N/A

C. PROPOSED SECONDARY WATER QUALITY TREATMENT

1. Proposed treatment recommendation: Oxidation-Filtration Treatment System
2. System Capex Estimate:

Capex					
	Total design flow rate =	23	GPM		
TASK	DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
1	Filter Skid, no recycle, sludge management systems required	1	EACH	\$ 50,000	\$ 50,000
2	Freight (based on shipping costs of similar size filters)	1	EACH	\$ 1,000	\$ 1,000
3	Engineering Design, Permitting, Bidding, & CA/CO (based on design costs of similar size filters)	1	EACH	\$ 42,500	\$ 42,500
4	Construction Bonding, Mobilization and Demobilization	1	EACH	\$ 2,000	\$ 2,000
5	Site Clearing, Grubbing, Grading, Gravel, erosion control	1	EACH	\$ 15,000	\$ 15,000
6	Existing Well House Piping Modifications	1	EACH	\$ 3,500	\$ 3,500
7	Filter Equipment Installation-Including but not limited to all water piping, water treatment filter installation, and necessary appurtenances, within the existing filter building. Also includes all extension piping near filter building	1	EACH	\$ 15,000	\$ 15,000
8	Filter Building Construction-Including but not limited to concrete floor slab, well house erection, finishing, and necessary appurtenances	1	EACH	\$ 35,000	\$ 35,000
9	Yard Piping-Including but not limited to all underground pipe, fittings, and valve	1	EACH	\$ 10,000	\$ 10,000
10	Electrical/Controls-Including but not limited to all electrical power and controls wiring, conduit, panels, fixtures, electric heaters, thermostats, junction boxes, control equipment not provide by filter manufacturer, and miscellaneous appurtenances	1	EACH	\$ 10,000	\$ 10,000
11	Aqua Direct Cost (payroll, water quality sampling) @	3%			\$ 5,520
TOTAL COST/TREATED GPM:					\$ 8,300
TOTAL ESTIMATED PROJECT COSTS:					\$ 190,000

Note: The above information is for planning purposes only and is subject to change based on further engineering evaluations, water quality analyses, site conditions, and other site-specific discoveries and information

3. Opex Estimate: \$9,000
4. Comments:

Aqua proposes installing an oxidation-filtration system at Foxboro Estates Well #3 in order to remove Fe/Mn below the sMCLs.