



SECONDARY WATER QUALITY TREATMENT SYSTEM REQUEST
Eagle Creek Wells #2,3 – Interconnection for Combined Treatment
NC 43-92-128
POE Location Code: P02, P03
AQUA NORTH CAROLINA, INC.

A. EXECUTIVE SUMMARY

Aqua is currently under a Notice of Deficiency for Well #3 for exceeding the sMCLs for Iron and Manganese in the Eagle Creek Master System. Well #1 has been inactivated since the Combined Radium Running Annual Average (RAA) exceeded the MCL at 5.45 pCi/L. The attached capacity calculations show the max day demand over the past 10 years and the minimum state design standards can both be met when Well #1 is offline and only Eagle Creek Wells #2&3 and Sanctuary Well #1 are run.

As a result, Aqua proposes interconnecting Wells #2&3 and installing an Iron (Fe) and Manganese (Mn) oxidation/filtration system to treat the flow from these wells. The Eagle Creek Master System is comprised of 4 wells and 4 separate points of entry (POEs). **Combined raw Fe and Mn levels at Well #3 are greater than 1.0 mg/L which makes it one of Aqua's Group 1 Priority Secondary Water Quality Projects as per the Water Quality Plan.** The latest combined raw Fe and Mn concentration at Well #3 was 1.173 mg/L as of 1/6/2020. According to Section 4.8.6 Sequestration by Polyphosphates of the Ten State Standards, "This process [sequestration] is not recommended when iron, manganese or combination thereof exceeds 0.5 mg/L and shall not be used when it exceeds 1.0 mg/L" (See attached email exhibit from PWSS-NCDEQ). Well #1 is currently a Group 2 and Well #2 is a Group 3 Priority filter site and the new Sanctuary Well #1 is a Group 4 site (activated 12/1/2019). Preliminary engineering studies indicate that Manganese Dioxide oxidation/filtration is the most effective and permanent solution since it physically removes Fe and Mn.

B. PROPOSED SYSTEM REQUIRING TREATMENT

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|---|-------------------------------|
| 1. System Name: | <u>Eagle Creek Wells #2,3</u> |
| 2. PWS ID: | <u>NC 43-92-128</u> |
| 3. No. active residential connections: | <u>115</u> |
| 4. No. permitted residential connections: | <u>134</u> |

5. List of DEH/PWSS Approved Wells and Storage

TABLE 1: Approved and Active Wells in Proposed System

Well Name and No.	Capacity (GPM)				Max, Avg., Min Pump Runtime from Past 12 Months (hrs./day)			Latest POE Inorganic Sampling Results				
	App.	Max, Avg., Min from Past 12 Months						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 #1	30	47	27	21	23	6	0.3	0.43	0.133	0.05	19	0.16
Well #2	20	23	21	13	4	2	1	0.26	0.090	0.01	3	0.03
Well #3	29	33	27	17	21	9	2	0.65	0.119	0.07	26	0.22
Sanctuary Well #1	91	93	91.7	90	7.1	1.7	0.6	0.0329	0.0175	0.00	2	0.01

*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.

TABLE 2: Existing Storage at Well Sites

Well Name and No.	Storage Description		Most Recent Cleaning Date	
	Type	Gallons	Tank	Dist. System
Well #1	Hydro	5,000	12/2019	11/18/2019
Well #2	N/A	N/A	N/A	11/18/2019
Well #3	N/A	N/A	N/A	11/18/2019
Sanctuary Well #1	N/A	N/A	N/A	11/18/2019

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

Response: April 2017, April 2018, April 2019.

7. Next Planned Distribution System Flushing Occurrence

Response: This water system will be flushed again in April 2020 and on an ongoing annual basis. Disclaimer: Flushing does not completely remove the mineral accumulation 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.	Chemical Description			
	Cl ₂	OP-37	NaOH	SeaQuest
#1	X	N/A	N/A	X
#2	X	N/A	N/A	X
#3	X	N/A	N/A	X
Sanctuary Well #1	X	N/A	N/A	N/A

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: Aqua started feeding SeaQuest at all three wells in Sept. 2015. Installed an automatic blow off at Well #3 in June 2017. In Sept. 2017, started distribution and POE total and soluble sampling, and started raw sampling in Dec. 2017. A cartridge filter was installed at Well #3 in Q2-2018. Aqua will continue to flush distribution system annually.

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

Response: None.

11. Comments on Approved/Current Well Capacity.

Response: No significant change between the approved and actual well productions.

C. CURRENT SECONDARY WATER QUALITY CONCERNS

- How many wells require treatment? 2
- Can system operate with any of the wells offline? Yes, EC Well #1*

*See attached system capacity calculations before and after filtration is installed.

- Are combined Fe/Mn concentrations above 1 mg/L or Mn above 0.3 mg/L? Yes*

* The latest combined raw Fe and Mn concentration at Well #3 was 1.173 mg/L as of 1/6/2020.

- Date of most recent POE Fe/Mn sampling results 4/16/2020

TABLE 4: Most Recent Fe/Mn Inorganic Analysis

Well #1 Laboratory Analysis						
Date	Iron (Fe) POE, mg/L			Manganese (Mn) POE, mg/L		
	Tot.	Sol.	Insol.	Tot.	Sol.	Insol.
4/17/2015	0.483	-	-	0.113	-	-
4/5/2018	0.621	-	-	0.122	-	-
4/16/2020	0.434	-	-	0.133	-	-
Well #2 Laboratory Analysis						
Date	Iron (Fe) POE, mg/L			Manganese (Mn) POE, mg/L		
	Tot.	Sol.	Insol.	Tot.	Sol.	Insol.
4/21/2015	0.551	-	-	0.163	-	-
4/10/2018	2.11	-	-	0.139	-	-
2/10/2020	0.433	-	-	0.14	-	-
4/16/2020	0.257	-	-	0.0896	-	-
Well #3 Laboratory Analysis						
Date	Iron (Fe) POE, mg/L			Manganese (Mn) POE, mg/L		
	Tot.	Sol.	Insol.	Tot.	Sol.	Insol.
5/15/2019	1.1	0.236	0.864	0.17	0.0686	0.1014
7/15/2019	0.816	0.732	0.084	0.158	0.152	0.006
8/8/2019	0.713	0.149	0.564	0.134	0.0781	0.0559
9/9/2019	0.129	0.0826	0.0464	0.0151	0.00919	0.00591
10/18/2019	0.715	0.129	0.586	0.138	0.08	0.058
11/4/2019	0.689	0.108	0.581	0.127	0.0579	0.0691
12/16/2019	0.787	0.109	0.678	0.132	0.0618	0.0702
1/6/2020	0.721	0.0929	0.6281	0.132	0.0644	0.0676
1/9/2020	0.744	-	-	0.117	-	-
2/10/2020	0.786	0.742	0.044	0.143	0.138	0.005
4/16/2020	0.651	0.0951	0.5559	0.119	0.0516	0.0674

Sanctuary Well #1 Laboratory Analysis						
Date	Iron (Fe) POE, mg/L			Manganese (Mn) POE, mg/L		
	Tot.	Sol.	Insol.	Tot.	Sol.	Insol.
12/3/2019	0.03	-	-	0.018	-	-

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

Response: Aqua flushes water mains annually in this system. Because sequestering does not physically remove Fe, Aqua is concerned that its efforts to reduce total Fe 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

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| 1. Well Location Map | <u>Attached</u> |
| 2. DEH/PWS Approval Letter | <u>Attached</u> |
| 3. Original 24 hr. Pump Status Report | <u>Attached</u> |
| 4. Past 36 months of pump status reports | <u>Attached</u> |
| 5. Inorganic Analysis Report submitted to DEH for well approval | <u>Attached</u> |
| 6. Past 6 yrs. inorganic analysis from each wellhead | <u>Attached</u> |
| 7. Past 3 yrs. Fe/Mn analyses, both soluble and insoluble. | <u>Attached</u> |

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

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| 1. Total number of customer complaints in past 6 months | <u>2</u> |
| 2. Total number of customer complaints in past 12 months | <u>5</u> |
| 3. For past 6 months, do customer secondary water complaints exceed 10% of the number of active customers? | <u>No</u> |
| 4. Provide 12-month list of all water quality complaints | <u>Attached</u> |
| 5. Provide 12-month list of all completed water quality work orders | <u>Attached</u> |
| 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: Black discolored water complaints.

F. PROPOSED SECONDARY WATER QUALITY TREATMENT

1. Proposed treatment recommendation: AdEdge Water Technologies Treatment system

2. Proposed System Cost:

ENGINEERING COST ESTIMATE-FILTERING WELLS #2&3					
TASK	DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
1	AdEdge Filter System, TRIPLEX 24 IN. VESSELS, NO BW SUPPLY, RECYCLE, OR SLUDGE SYSTEM SINCE LESS THAN 5,000 BW/WEEK	1	EACH	\$ 92,000	\$ 92,000
2	Sales Tax (7.25% combined sales tax for Wake County, NC)	1	EACH	\$ 6,670	\$ 6,670
3	Freight (based on shipping costs of similar size filters)	1	EACH	\$ 1,000	\$ 1,000
4	Engineering Design, Permitting, Bidding, & CA/CO (based on design costs of similar size filters)	1	EACH	\$ 30,000	\$ 30,000
	Construction:				
5	Interconnecting raw water supply mains from Well #3 to Well #2	500	FT	\$ 60	\$ 30,000
6	Bonding, Mobilization and Demobilization	1	EACH	\$ 5,000	\$ 5,000
7	Site Clearing, Grubbing, Grading, and Gravel	1	EACH	\$ 20,000	\$ 20,000
	Existing Well House Piping Modifications	1	EACH	\$ 3,500	\$ 3,500
8	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	\$ 25,000	\$ 25,000
9	Filter Building Construction-Including but not limited to concrete floor slab, well house erection, finishing, and necessary appurtenances	1	EACH	\$ 35,000	\$ 35,000
10	Yard Piping-Including but not limited to all underground pipe, fittings, and valve	1	EACH	\$ 20,000	\$ 20,000
11	Electrical/Controls-Including but not limited to all electrical power and controls wiring, conduit, panels, fixtures, electric heaters, thermostats, junction boxes, control equipment not provided by filter manufacturer, and miscellaneous appurtenances	1	EACH	\$ 25,000	\$ 25,000
12	Erosion and Sedimentation Control	1	EACH	\$ 5,000	\$ 5,000
13	Aqua Direct Cost (payroll, water quality sampling) @	5%			\$ 14,909
14	Contingencies @	5%			\$ 15,654
				TOTAL CAPITAL COSTS:	\$ 330,000
15	AFUDC @	7%			\$ 23,100
TOTAL ESTIMATED PROJECT COSTS/GPM:					\$ 7,400
TOTAL ESTIMATED PROJECT COSTS:					\$ 360,000

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

Estimated annual operating and maintenance expenses: \$1,000.00

3. Comments: Fe and Mn levels at Well #2 are consistently greater than 1.0 mg/L which makes it one of Aqua's Group 1 Priority Secondary Water Quality Projects as per the Water Quality Plan. Aqua will use 50 GPM as the treatment system design (max) flow rate.

For these reasons, Aqua proposes installing an AdEdge Iron (Fe) and Manganese (Mn) filter system to treat the flow at Eagle Creek Wells #2&3.