



SECONDARY WATER QUALITY TREATMENT SYSTEM REQUEST

River Oaks NC 03-92-096

WSF ID No: P02

AQUA NORTH CAROLINA

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A. EXECUTIVE SUMMARY

Aqua proposes installing an AdEdge Iron (Fe) and Manganese (Mn) filter system to treat water at the single-entry point of River Oaks Well #3. This system is part of the River Oaks Master System.

NCDEQ issued a Notice of Deficiency in July 2016 due to Fe and Mn levels exceeding the secondary limits. Combined Fe and Mn levels at this well are more than 1 mg/L which makes it one of Aqua's Group 1 Priority Secondary Water Quality Projects as per the 2018 Water Quality Plan. 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 Fe/Mn 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: | River Oaks PWS |
| 2. PWS ID: | NC 03-92-096 |
| 3. No. Customers Being Served: | 47 |
| 4. No. Customers at Build Out: | 47 |
| 5. List of DEH/PWSS Approved Wells and Storage | |

TABLE 1: Approved and Active Wells in Proposed System

Well Name and No.	Capacity (GPM)		Past 12-Month Avg. Pump Runtime (hrs./day)	Average Inorganic Sampling Results				
	App.	Average		POE Fe (mg/L)****	POE 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, P01***	30	27	11	0.0888	0.0733	~0.02	~8.79	~0.07
Well #3, P02	50	67	3*	1.86	0.165	~0.81	~297.37	~2.43

*Well #3 will operate in lag mode and will only be used during heavy peak demand (summer months) until treatment can be installed.

**Loading rate estimates based on 12 hr./dy. runtimes (50% utilization) for wells in lag mode/offline.

*** Interconnection and consolidated treatment between Wells #1 and #3 is not cost effective given they are ~1,500 ft. apart and the interconnect would travel mostly through densely wooded areas and underneath a major roadway. Well-1 is also below the sMCL for Fe and only slightly above the sMCL for Mn. See attached well site map.

****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 Site

Well Name and No.	Storage Description		Most Recent Cleaning Date	
	Type	Gallons	Tank*	Dist. System
Well #1, P01	Hydro	5,000	Feb. 2018	May 2018
Well #3, P02	N/A	N/A	N/A	N/A

*Tank is scheduled to be replaced in 2020.

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

Response: June 2016, May-June 2017, Aug. 2018.

7. Next Planned Distribution System Flushing Occurrence

Response: May 2019.

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
Well #3, P02	X	N/A	N/A	X

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: The system switched from OP 37 to SeaQuest in September 2015 to sequester the Fe and Mn; Started distribution and Point of Entry (POE) total and soluble sampling in Sept. 2017; Added raw sampling and testing in Dec. 2017. Will continue to flush 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: The average capacity is ~17 GPM above the approved capacity because the well is only run in lag mode and is used during heavy peak demand (summer months) time periods, causing the average flowrate to increase above the approved rate. Once Fe/Mn filtration is installed, Well-3 will be taken out of lag mode by operations and the production will level out to the approved value.

C. CURRENT SECONDARY WATER QUALITY CONCERNS

1. How many wells require treatment? 1
2. Can system operate with single well offline? No*

*Based on the historical demands from the River Oaks Water System, both Well #1&3 are required to meet demand. Subsequently, the production from River Oaks Well-3 is required and needs to be brought back fully online as soon as well water quality can be improved to meet the sMCLs.

3. Are combined Fe/Mn concentrations above 1 mg/L? Yes*

*The average combined POE concentration is ~2.03 mg/L (Fe+Mn) from Table 1 above.

4. Date of most recent POE Fe/Mn sampling results 8/8/2018

TABLE 4: Most Recent Fe/Mn Inorganic Analysis at Point of Entry (POE)

River Oaks Laboratory Analysis						
Date	Iron (Fe) POE, mg/L			Manganese (Mn) POE, mg/L		
	Tot.	Sol.	Insol.	Tot.	Sol.	Insol.
1/16/2018	Outlier			0.213	0.212	0.001
2/13/2018	2.08	1.95	0.13	0.168	0.168	0
3/9/2018	Outlier			0.183	0.176	0.007
4/13/2018	2.35	<0.0220	2.35	0.133	0.128	0.005
5/1/2018	2.81	1.34	1.47	0.178	0.164	0.014
6/15/2018	1.46	0.771	0.689	0.132	0.131	0.001
8/8/2018	Outlier			0.141	0.141	0

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

Response: The system switched from OP 37 to SeaQuest in June. 2015 to sequester the Fe and Mn. Flushed distribution system annually since July 2016 and will continue to flush water mains annually. Aqua began collecting and testing total and soluble sampling in Sept. 2017 and the results are noted in Table 4 above. 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 Fe/Mn filtration or equivalent filtration such as 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 for Well #3 | <u>Attached</u> |
| 3. Original 24 hr. Pump Status Report and Well Driller's Log | <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 (7) 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>0</u> |
| 2. Total number of customer complaints in past 12 months | <u>2</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: Brown water complaints. Despite the fact there have been only 2 customer complaints in the past 12 months, the adverse health effects and public health issues resulting

from elevated levels of Mn concentrations make removal by Fe/Mn filtration the most prudent and responsible step moving forward.

F. PROPOSED SECONDARY WATER QUALITY TREATMENT

1. Proposed treatment recommendation: AdEdge Water Technologies Filtration
2. Proposed System Costs: \$274,000.00
3. Estimated annual operating and maintenance expenses: \$1,000.00
4. Comments: The water quality at this well has resulted in a NOD from NCDEQ since July 2016 and the average combined Fe and Mn concentration is greater than 1 mg/L, making this well one of Aqua's Group 1 Priority Secondary Water Quality Projects as per the 2018 Water Quality Plan. The elevated levels of Mn also pose a health risk to customers. Unless treatment is installed, this well will continue to operate in lag mode. Once treatment is installed, Well-3 will operate near the approved rate of 50 GPM and Aqua will use this as the treatment system design flow rate.

For these reasons, Aqua proposes an AdEdge filtration system for Fe and Mn removal to be installed at River Oaks Well #3.