Old Pilot test

TABLE 1-1

Inorganic Water Quality for the Wiegardt Wellfield

Parameter	Well 1	Well 2	Well 3	MCL
Iron (mg/L)	<0.1	<0.02	<0.02	0.30
Manganese (mg/L)	<0.01	<0.005	<0.01	0.05
Arsenic (mg/L)	0.016(1)	0.016(1)	0.015(1)	0.01
pH (Laboratory)	7.4	8.41	8.48	—
Alkalinity (mg/L as $CaCO_3$)	NA(2)	56.3	58.7	—
Hardness (mg/L as $CaCO_3$)	52	41.8	49.5	—
Conductivity	178	189	197	700
TDS (mg/L)	122	129	129	500
Nitrate (mg/L)	<0.2	<0.1	ND(2)	10
Chloride (mg/L)	28	20.1	19.2	250
Sulfate (mg/L)	5	3.99	4.39	250
Sulfide (mg/L)	0.024	NA	NA	—
Calcium (mg/L)	22	NA(2)	NA(2)	—
Turbidity	0.8	ND(2)	ND(2)	—
Silica	34	34.0	36.1	—
Total Organic Carbon (TOC)	NA	ND	ND	—

(1) Exceeds the regulatory MCL.
(2) ND = Not detected and NA = Not analyzed.

Initial water quality testing for Well 3 showed the presence of trace amounts of Paraquat in the raw water. However, subsequent testing performed on March 5, 2015, indicated no Paraquat in the raw water.

PILOT STUDY OBJECTIVES

The primary goal of the pilot study is to determine the feasibility of using air injection, ferric chloride addition, and catalytic carbon filtration to treat water from the new Wiegardt Wells. The pilot study is also intended to determine the design parameters for a full-scale application.

TREATMENT TECHNIQUE CHEMISTRY

The treatment scheme of air injection, ferric chloride addition, and catalytic activated carbon filtration is an amalgam of catalytic carbon treatment for hydrogen sulfide and ferric chloride co-precipitation for arsenic. The chemistry of the two processes is described below.

Catalytic activated carbon can be used to remove hydrogen sulfide from drinking water. The hydrogen sulfide is adsorbed to the activated carbon surface without prior oxidation. The activated carbon is of a special catalytic type that can catalyze the oxidation of

TERMINAL HEAD LOSS

Head loss across the filter was measured during Runs 2 through 4 as described previously. A plot of head loss across the filter with respect to time is shown on Figure 3-4. In each case, the clean bed head loss was approximately 1 psi. During these runs, head loss across the filter increased linearly at the approximate rate of 0.6 psi per hour. The terminal head loss for Runs 2 through 5 ranged from 4.1 to 5.2 psi.

The approximately linear increase in head loss with time implies a relatively uniform utilization of filter bed depth. Therefore, it would be appropriate to extrapolate head loss linearly for increased filter bed depths. Assuming a pilot scale terminal head loss of 5 psi, the approximate terminal head loss per inch of media depth is approximately 0.18 psi.

CONCLUSIONS AND RECOMMENDATIONS

The results of the pilot study demonstrate that aeration followed by ferric hydroxide co-precipitation and filtration can achieve the pilot study goals of reliably removing arsenic to approximately 5 µg/L (50 percent of the MCL) and treating hydrogen sulfide to below detectable levels. This treatment strategy was also effective at removing hydrogen sulfide to below detectable levels. Therefore, this treatment concept is recommended for full-scale design to accommodate the entire production capacity of the Wiegardt Wellfield.

We make 100,000 Gallons then Backwash.

FULL-SCALE DESIGN PARAMETERS

The Wiegardt Wellfield will produce 450 gpm. Based on a hydraulic loading rate of 4.5 gpm/sf, approximately 100 square feet of filter area will be required. Therefore, full-scale treatment could be provided by two 8-foot diameter filters with a combined area of approximately 100.5 square feet.

Calgon Carbon manufactures a carbon adsorption system consisting of two 8-foot diameter filter tanks. Each tank supports a media depth of 72 inches, providing a combined media volume of approximately 603 cubic feet. Based on the specific media capacity of 14,250 mg iron per cubic foot of media, approximately 568,000 gallons of water can be treated prior to backwash (at a ferric chloride dose of 4 mg/L), equating to a theoretical full-scale backwash interval of approximately 21 hours.

FERRIC CHLORIDE DOSAGE

Arsenic removal to 50 percent of the MCL was demonstrated with a minimum ferric chloride dose of 4 mg/L. A dose of 5 mg/L further improved arsenic removal to 10 percent of the MCL, but yielded a slightly reduced filter run time. Therefore, chemical feed equipment will be designed to provide a ferric chloride dosage of 4 to

5 mg/L. This dosage is a design target; the actual optimal dosage will be determined during full-scale startup and commissioning. where in the 20mg/L Range now.

TERMINAL HEAD LOSS

Assuming a terminal head loss of 0.18 psi per inch of media depth, a full-scale filter with 72 inches of media depth would have an expected terminal head loss somewhere around 13 psi. However, it should be noted that the upper limit of this range assumes uniform floc entrainment across the depth of the filter and an associated linear increase in head loss with media depth.

BACKWASH

A backwash flow rate of 15 gpm/sf for a duration of 10 minutes provided complete removal of iron hydroxide floc entrained in the filter media. Therefore, the full-scale filter will require a backwash flow rate of approximately 750 gallons per minute per filter. This equates to 7,500 gallons per filter or approximately 1.3 percent of the 568,000 gallons produced during a filter run.

Table 3-9 provides a summary of the full-scale design parameters.

TABLE 3-9

Full-Scale Design Parameters

Parameter	Value
Design Flow Rate	450 gpm
Filter Vessel Diameter	8 feet
Number of Filter Vessels	2
Hydraulic Loading Rate	4.5 gpm/sf
Minimum Ferric Chloride Dose	4.0 mg/L (1)
Potassium Permanganate Dose Range	0.1 to 2.0 mg/L
Ferric Chloride Contact Time	2 minutes
Carbon Bed Depth	72 inches
Carbon Volume	603 cubic feet
Empty Bed Contact Time	10 minutes
Specific Filtration Capacity	12.6 g Fe/cf carbon
Time to Breakthrough	~21 hours (2)
Approximate Terminal Head Loss	13 psi
Backwash Flow Hydraulic Loading	15 gpm/sf
Backwash Flow Rate	750 gpm

(1) Improved arsenic removal was demonstrated at higher ferric chloride dosages. Four mg/L is the minimum dosage required to achieve arsenic removal to 50 percent of the MCL.

(2) The time to breakthrough is approximate based on the specific capacity of the carbon media developed during pilot testing.