MISSISSIPPI STATE DEPARTMENT OF HEALTH

REPORT OF INSPECTION OF DRINKING WATER SUPPLY

PWS: 0250008 **Class:** A

An inspection of the CITY OF JACKSON water supply in HINDS county was made on 11/21/2019. Present at the time of inspection was TERENCE A BYRD, OPERATOR; WRITER. Official CHARLES E WILLIAMS JR Address PO BOX 17 JACKSON MS 39205 W.W. Operator TERENCE A BYRD Address 2430 LADD STREET JACKSON MS 39209 No. Connections 71486 No. Meters ___ Population Served 173514 Field Chemical Analysis: pH ___ Cl2(free) ___ Cl2(total) ___ H2S N/A Iron ___ Fluoride ___ Point of Sampling DISTRIBUTION Water Rates ___ This inspection included a sanitary survey for compliance with the Ground Water Rule.

COMMENTS

Technical: 2 Managerial: 5 Financial: 4

OVERALL CAPACITY RATING: 3.7 / 5.0

1. This annual inspection also served as the City's Sanitary Survey. There was one significant deficiency noted during the Survey. At the time of inspection, the City was not meeting both the target pH and alkalinity at both plants. The pH was being met at both plants, but the alkalinity was not at least 35 mg/L. This led to the loss of Capacity Assessment T1 and T2-1.

2. The Fewell & OB Curtis plants were inspected on November 18, 2019. City personnel in attendance were Terence Byrd, James Perry, Chris Ward, Leander Crowley, and LaTanya Thomas. All elevated tanks, wells, and booster stations were inspected on November 19 and in attendance were Terence Byrd and James Perry. Records were reviewed on November 21. Present during the records review were Bill Miley, Mary Carter, Tim Caine, and Terence Byrd.

3. It is vital that both O.B. Curtis and J.H. Fewell be fully staffed with licensed Class A water operators and capable maintenance staff. The City's water treatment is not a simple undertaking and involves complex processes that require 24/7 monitoring and adjustment. These operators are necessary to keep everything running smoothly and ensuring all Federal Safe Drinking Water Act Standards are met.

4. The conventional operations at both plants are meeting the requirements of the Long Term 2 Enhanced Surface Water Treatment Rule.

5. As a reminder, UV disinfection at both plants must be operated at all times that the filters/service pumps are online. Credit can be given for 3.0 log removal for the conventional filtration plants if they maintain filter effluent turbidities of <0.3 NTU 95% of the time. However, the remaining 2.5 log inactivation of Crypto must be achieved with the UV and membranes. No disinfection credit will be given for Crypto using free chlorine or chloramines, therefore properly operating UV and membranes units will be essential.

6. It is important that anytime a UV unit is taken offline, and the corresponding filter or high service pump remains online, the City is able to demonstrate that the appropriate free chlorine concentration is maintained between the point of chlorine injection and the point of ammonia injection in order to inactivate viruses. Calculations should be kept in the plant records showing that the appropriate CT is maintained anytime a service pump remains online with a UV unit down at either plant. Alternatively, the high service pump can be taken offline when its UV is down.

7. The two years of monthly crypto and E.Coli analysis concluded September 2019. As of the writing of this report, the sample data had not yet been entered into the State Drinking Water Information System. Once this data has been entered, then any change in Bin can be made. From conversations with Terence Byrd and City contractor, Cynthia Hill, it appears that the City will move from Bin 4 to Bin 2. Once the Bin assignment is changed, a new design capacity will be completed.

CAPACITY ASSESSMENT COMMENTS

8. Updated target for pH is 9.0 or greater and updated target for alkalinity is 35 mg/L or greater. At the time of inspection, both plans were meeting the pH target but not the alkalinity. (T1, T2-1)

9. The City is under a State issued Compliance Plan to resolve Lead and Copper problems. As of the time of inspection, soda ash had been online at OB Curtis for a week.

10. The microscreens at OB Curtis were out of service on both the conventional and membrane treatment trains. Having this part of the treatment process out of service greatly impacts the amount of water able to be made. These need to be repaired and back in service as soon as possible. (T2-2)

11. Mr. Perry does a great job in making sure that all elevated tanks are inspected at least every five years. To continue receiving credit for T2-3, the City must follow up on the deficiencies noted in the tank inspection reports.

12. As a reminder, a Class A operator must be onsite at all times. (T3-1, T3-2)

13. Quarterly water loss calculations were presented at the time of inspection. The report showed that water loss was around 50% each quarter. (T4-1)

14. Credit was not given for T5-1 because the system does not have the ability to provide water during a prolonged power outage. In order to get credit next year, the City will need to obtain generators capable of keeping pressure in the system during a prolonged power outage.

15. Credit was not given for T5-2 because the City needs both treatment plants and the wells to provide water for all customers. If any of them were to go offline, the others could not compensate.

16. Mr. Miley provided a recent cut-off list for the City. They are continuing to work with cusotmers to get current on their bills before cutting off.

17. The most recent audit available was for FY17. (F5)

*** FEWELL PLANT COMMENTS ***

18. The turbidities of all online filters were less than 0.3 NTU at the time of inspection. Turbidity readings are automatically saved every 5 minutes.

19. The following analyses were completed on the finished water from the plant and the results were as follows: Turbidity = 0.21; pH = 9.28; Total Chlorine Residual = 3.7 mg/L; Free Chlorine Residual = 0.3 mg/L; Color = 14; Manganese = 0.06 mg/L; Fluoride = 0.8 mg/L; Free ammonia = 0.35 mg/l; Monochloramine = 2.9 mg/l; Alkalinity = 14 mg/L; Hardness = 58 mg/L; Iron = 0.02 mg/L. The total plant output was 20.0 MGD.

*** O.B. PLANT COMMENTS***

20. The turbidities of all online filters and online membrane trains were less than 0.3 NTU at the time of inspection.

21. Mr. Crowley reported that five of the six membrane trains were online at the inspection. All five were not passing MIT at the time of inspection due to issues with the MIT system. While all turbidimeters and particle counters were online, it is important that the MIT system be functioning on all six trains.

22. It was reported that train 6 was scheduled to have a full module/fiber replacement by the end of the year.

23. It was reported that an enclosure for the membranes was in the planning stages. We support the efforts to move forward with providing a cover for the membranes to keep them in a temperature controlled environment. An enclosure would prolong the life of the membrane fibers.

24. Mr. Crowley reported that the City is working toward replacing its turbidimeters with a meter that reads to 4 decimal places to be able to get rid of the particle counters. A new turbidimeter was installed on train 2 as a trial. At the time of inspection it was reading 0.0242 NTU

25. To improve the effectiveness of filter backwashing, it is recommended that all filters have a functioning surface wash system.

26. The average flow rate was 14 MGD from the conventional side and 11 MGD from the membrane side.

27. The following analyses were completed on the finished water from High Service 1, which is predominantly water from the conventional side: Turbidity = 0.2; pH = 9.98; Total Chlorine Residual = 3.3 mg/L; Free Chlorine Residual = 0.1 mg/L; Alkalinity = 35 mg/L; Hardness = 15.5 mg/L; Iron = 0.01 mg/L; Manganese = 0.012 mg/L; Free ammonia = 0.1 mg/L; Monochloramine = 3.27 mg/L; Color = 2 units; Fluoride = 0.7 mg/L (combined).

28. The following analyses were completed on the finished water from High Service 2, which is predominantly water from the membrane side: Turbidity = 0.135; pH = 9.76; Total Chlorine Residual = 2.6 mg/L; Free Chlorine Residual = 0.3 mg/L; Alkalinity = 22.6 mg/L; Hardness = 23.4 mg/L; Iron = 0.01 mg/L; Manganese = 0.058 mg/L; Fluoride = 0.74 mg/L (combined); Free ammonia = 0.55 mg/L; Monochloramine = 2.38 mg/L; Color = 2 units.

*** GENERAL REMINDER COMMENTS ***

29. When repairs are made on the distribution system, all lines affected should be properly chlorinated and flushed before they are placed back in service.

30. Whenever system pressure is lost, even for brief periods of time, contaminants may be introduced to the system through back-siphonage and/or back flow. When this occurs, system officials should notify all customers in the affected area to boil their drinking water vigorously for one minute. This boil water notice should remain in effect until clear bacteriological samples have been obtained.

Completed by Amy L. McLeod, E.I. on 12/13/2019.

Reviewed by Greg Caraway, P.E. on 12/16/2019.

If you have any questions, please call (601)576-7518.

pc:

CHARLES E WILLIAMS JR, OFFICIAL
TERENCE A BYRD, OPERATOR

Mississippi Department of Health
Bureau of Public Water Supply

STANDARD FORM

FY 2020 Public Water System Capacity Assessment Form

NOTE: This form must be completed whenever a routine sanitary survey of a public water system is conducted by a regional engineer of the Bureau of Public Water Supply

PWS ID#: 0250008 Class: A Survey Date: 11-21-2019 County: HINDS
Public Water System: CITY OF JACKSON Conn: 71486
Certified Waterworks Operator: TERENCE A BYRD Pop: 173514

CAPACITY RATING DETERMINATION

Technical (T) Capacity Rating: [**2**] Managerial (M) Capacity Rating [**5**] Financial (F) Capacity Rating [**4**]

Capacity Rating = $\frac{T + M + F}{3} = \frac{11}{3} = 3.7$

Overall Capacity Rating = 3.7

Completed by Amy L. McLeod, E.I. on 12/11/2019
Reviewed by Greg Caraway, P.E. on 12/16/2019

Comments:

Technical Capacity Assessment	Point Scale	Point Award
[T1] Does the water system have any significant deficiencies? [(Y) N]	N - 1pt. Y - 0pt.	0
[T2] 1) Was the water treatment process functioning properly? [Y (N)] (i.e. Is pH, iron, chlorine, fluoride, etc. within acceptable range?) **2)** Was needed water system equipment in place and functioning properly at the time of survey? [Y (N)] (**NOTE:** Equipment deficiencies must be identified in survey report.) **3)** Were records available to the regional engineer clearly showing that all water storage tanks have been inspected and cleaned or painted (if needed) within the past 5 years? [(Y) N NA] (**NOTE:** All YESs required to receive point)	All Y - 1 pt. Else - 0 pt.	0
[T3] 1) Was the certified waterworks operator or his/her authorized representative present for the survey? [(Y) N] **2)** Was PWS Operations record up to date and properly maintained? [(Y) N] (Are minimum days being met based on system classification) **3)** Was the water system properly maintained at the time of survey? [(Y) N] **4)** Did operator/system personnel satisfactorily demonstrate to the regional engineer that he/she could fully perform all water quality tests required to properly operate this water system? [(Y) N] (**NOTE:** All YESs required to receive point)	All Y - 1 pt. Else - 0 pt.	1
[T4] 1) Does water system routinely track water loss and were acceptable record available for review? [(Y) N] **2)** Is water system overloaded? (i.e. serving customers in excess of MSDH approved design capacity)? [Y (N)] **3)** Was there any indication that the water system is/has been experiencing pressure problems in any part(s) of the distribution system? [Y (N)] (based on operator information, customer complaints, MSDH records, other information) **4)** Are well pumping tests performed routinely? [(Y) N NA] (**NOTE:** YES FOR #1 & YES OR N/A FOR #4 AND NOs FOR #2 & #3 required to receive point)	1)Y - pt. 2)N - pt. 3)N - pt. 4)Y - pt.	1
[T5] 1) Does the water system have the ability to provide water during power outages? (i.e. generator, emergency tie-ins, etc.) [Y (N)] **2)** Does the water system have a usable backup source of water? [Y (N)] (**NOTE:** Must be documented on survey report)	All Y - 1 pt. Else - 0 pt.	0
TECHNICAL CAPACITY RATING = [2] (Total Points)		

Public Water System: CITY OF JACKSON PWS ID #: 0250008

FY 2020 Public Water System Capacity Assessment Form Survey Date: 11-21-2019

Managerial Capacity Assessment	Point Scale	Point Award
[M1] Were all SDWA required records maintained in a logical and orderly manner and available for review by the regional engineer during the survey? [(Y) N]	Y - 1pt. N - 0pt.	1
[M2] 1) Have acceptable written policies and procedures for operating this water system been formally adopted and were these policies available for review during the survey? [(Y) N] **2)** Have all board members (in office more than 12 months) completed Board Member Training? [(Y) N NA] **3)** Does the Board of Directors meet monthly and were minutes of Board meetings available for review during the survey? (**NOTE:** Quarterly meetings allowed if system has an officially designated full time manager) [(Y) N NA] (**NOTE:** ALL YESs or NAs required to receive point. NA - Not Applicable)	All Y - 1 pt. Else - 0 pt.	1
[M3] Has the water system had any SDWA violations since the last Capacity Assessment? [Y (N)]	N - 1pt. Y - 0pt.	1
[M4] Has the water system developed a long range improvements plan and was this plan available for review during the survey? [(Y) N]	Y - 1pt. N - 0pt.	1
[M5] 1) Does the water system have an effective cross connection control program in compliance with MSDH regulations? [(Y) N] **2)** Was a copy of the MSDH approved bacti site plan and lead/copper site plan available for review during the survey and do the bacti results clearly show that this approved plan is being followed? [(Y) N] (**NOTE:** All YESs required to receive point)	All Y - 1 pt. Else - 0 pt.	1
MANAGERIAL CAPACITY RATING = [5] (Total Points)		

Financial Capacity Assessment	Point Scale	Point Award
[F1] Has the water system raised water rates in the past 5 years? [(Y) N] (**NOTE:** Point may be awarded if the water system provides acceptable financial documentation clearly showing that a rate increase is not needed, i.e. revenue has consistently exceeded expenditures by at least 10%, etc.)	Y - 1pt. N - 0pt.	1
[F2] Does the water system have an officially adopted policy requiring that water rates be routinely reviewed and adjusted as appropriate and was this policy available for review during the survey? [(Y) N]	Y - 1pt. N - 0pt.	1
[F3] Does the water system have an officially adopted cut-off policy for customers who do not pay their water bills, was a copy of this policy available for review by the regional engineer, and do system records (cut-off lists, etc.) clearly show that the water system effectively implements this cut-off policy? [(Y) N]	Y - 1pt. N - 0pt.	1
[F4] Was a copy of the water system's officially adopted annual budget available for review by the regional engineer and does the water system's financial accounting system clearly and accurately track the expenditure and receipt of funds? [(Y) N]	Y - 1pt. N - 0pt.	1
[F5 - Municipal Systems] 1) Was a copy of the latest audit report available for review at the time of the survey? [Y (N)] **2)** Does this audit report clearly show that water and sewer fund account(s) are maintained separately from all other municipal accounts? [(Y) N] (**NOTE:** Yes answer to all questions required to receive point.)	All Y - 1 pt. Else - 0 pt.	0
[F5 - Rural Systems] 1) Was the latest financial report / audit report available for review? [Y N] **2)** Does the latest financial report show that receipts exceeded expenditures? [Y N] (**NOTE:** Yes answer to both questions required to receive point)	All Y - 1 pt. Else - 0 pt.	
FINANCIAL CAPACITY RATING = [4] (Total Points)		

MISSISSIPPI DEPARTMENT OF HEALTH
BUREAU OF PUBLIC WATER SUPPLY
DESIGN CAPACITY SHEET

System: **CITY OF JACKSON**
ID: **0250008** Class: **A** County: **HINDS**

Date Completed: **11/25/2020**
Connections - Actual: **65640** Equivalent: **84521**
Design Capacity: **107639** Percent Design Capacity: **84521/107639 = 78.5%**

J H FEWELL WATER TREATMENT PLANT

**** CT calculations for FEWELL *****
There are four disinfection segments at Fewell, and the contact time must be determined for each segment to achieve 4-log inactivation of viruses, 3-log inactivation of Giardia, and 3.5-log inactivation of Crypto.

Fewell is required to achieve 0.3 turbidity units 95% of the time to comply with the SWTR. If this treatment is achieved, credit can be given for 2-log removal of viruses & Crypto and 2.5-log removal of Giardia. Free chlorine, chloramination, and UV disinfection must then attain the remaining 2-log inactivation of viruses, 0.5-log inactivation of Giardia, and 1.5-log of Crypto.

Book values:
CT required for 0.5-log inactivation of giardia at 10C and pH at 6.5 = 19 mg/L min
CT required for 2-log inactivation of viruses at 10C and pH at 6.5 = 3 mg/L min

The first segment is free chlorine contact between the point of chlorine injection (at the head of the outlet pipe from the sedimentation basin) and the point of ammonia injection (at the end of the outlet pipe just prior to ammonia injection).

The second is the contact time of free chlorine in the filters during normal filter operation.

The third is the contact time in the clearwell.

The fourth is the UV disinfection.

BASED ON THE TURBIDITY FILTER DATA SUBMITTED ON MONTHLY OPERATING REPORTS, MSDH IS SETTING A MAXIMUM TREATMENT CAPACITY OF 20 MGD. THE 7/13 MGD SPLIT BETWEEN BASINS IS BASED ON STANDARD OPERATION WHEN 20 MGD IS BEING TREATED.

CHLORINE RESIDUALS AND FLOW RATES UPDATED TO REFLECT WHAT THE PLANT WAS TREATING ON 11/09/20

CT SEGMENT 1 (pipes between sed basins and ammonia injection):
The free chlorine is measured by chlorine analyzers which communicate with the ammonia feed system. The concentration of free chlorine in the pipe between Sed Basin #3 and the filters was 3.53 mg/L. The concentration of free chlorine in the pipe between Sed Basin #4 and the filters was 4.58 mg/L.

Calculating the free chlorine contact time between chlorine injection and ammonia injection (at maximum design flows):

Sed basin #3: Pipe dimensions: Length = 351 ft; Diameter = 42 in = 3.5 ft.
Volume in pipe = 0.785 x 3.5 x 3.5 x 351 x 7.48 = 25,247 gallons
Estimated flow through Sed basin #3 train: 4 MGD
Contact time = 25,247 gallons/4,000,000 gal/day x 1440 min/day = 9.09 min

Sed basin #4: Pipe dimensions: Length = 357 ft; Diameter = 48 in = 4 ft.
Volume = 33,540 gallons
Estimated flow through Sed basin #4 train: 15 MGD
Contact time = 33,540/15,000,000 x 1440 = 3.22 min

CT SEGMENT 1 (using shortest contact time of 3.22 min) = 4.38 mg/L x 3.22 min
= 14.1 mg/L min

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(Note: Virus inactivation is achieved in Segment 1; 14.1 mg/L min > 3 mg/L min)

SEGMENT 1 LOG INACTIVATION = 14.1 mg/L min/19 mg/L min * (0.5 log) = 0.37 log

CT SEGMENT 2 (Disinfection in filters):
Disinfectant contact time between filters and clearwell/storage outlet:
Calculate volume of water in filters and estimated residence time:
Volume = L X W X D (where D = depth of water above filter media)
= (20 ft x 10 ft x 1.5 ft) * 7.48 gal/cu.ft. * 8 filters +
(25 ft x 28 ft x 3 ft) * 7.48 gal/cu.ft. * 3 filters
= 17,952 gallons + 47,124 gallons
= 65,076 gallons
Residence time = (65,076 gallons/19,000,000 gallons/day)* 1440 min/day
Residence time = 4.93 minutes

CT SEGMENT 2 (assuming chlorine concentration = finished water chlorine concentration = 0.3 mg/L)
CT SEGMENT 2 = 0.2 mg/L * 4.93 minutes = 0.986 mg/L min

SEGMENT 2 LOG INACTIVATION = 0.986 mg/L min / 19 mg/L min * (0.5 log) = 0.026 log

CT SEGMENT 3 (Disinfection in the clearwell):
Using the clearwell volume of 3.8 MG and a pre-determined baffling factor of 0.233:
Contact time = 3.8 MG/20 MGD x 1440 minutes/day x 0.233 = 63.7 minutes
Free chlorine measured in finished water = 0.2 mg/L
CT SEGMENT 3 = 63.7 minutes x 0.2 mg/L = 12.7 mg/L min
SEGMENT 3 LOG INACTIVATION = 12.7 mg/L min / 19 mg/L min * (0.5 log) = 0.34 log

Total CT using free chlorine = (14.1 + 0.986 + 12.7) mg/L min = 27.8 mg/L min

Total LOG INACTIVATION using free chlorine = SEGMENT 1 + SEGMENT 2 + SEGMENT 3
Total LOG INACTIVATION using free chlorine = 0.37 + 0.026 + 0.34 = 0.736 log

CT SEGMENT 4 (UV Disinfection):
At the time of the inspection, Pump 3 was pumping 7.9 MGD and dosing 26.4 mJ/sq.cm and Pump 4 was pumping 7.9 MGD and dosing 27.4 mJ/sq.cm.

According to 40 CFR 141.720 (d)(1), a dose of 3.9 mJ/sq.cm. will achieve a 1.5 log inactivation of Crypto and 1.5-log inactivation of Giardia. Therefore, the UV disinfection more than adequately achieves the remaining inactivation of Giardia & Crypto.

NOTE: Any time that the UV disinfection is offline on any service pump, that service pump MUST be taken offline as free chlorine is not enough to achieve the log credit removal for Crypto.

*** FEWELL DESIGN CAPACITY ****
Rated treatment capacity of plant = 20 MGD (limiting factor)
Clearwell volume = 3.8 MG
2 additional ground storage tanks @ 5MG each = 10 MG
Total storage located at the plant = 3.8 MG + 10 MG = 13.8 MG
Usable storage (volume filled in 6 hours) = 20 MGD/24 hrs/day x 6 hrs = 5 MG
Plant capacity = rated treatment capacity of plant + usable storage/200 minutes
Plant capacity = 20 MGD + (5 MG/200 min * 1440 min/day) = 56 MGD
Service pump capacity = (9+9+9+7) = 34 MGD

FEWELL DESIGN CAPACITY = 20,000,000 gal/day/1440 min/day = 13,889 GPM

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O B CURTIS WATER TREATMENT PLANT

**** CT calculations for OB Curtis ****

This plant must meet 4-log inactivation of viruses, 3-log inactivation of Giardia, and 3.5-log inactivation of Crypto.

The conventional side is required to achieve 0.3 turbidity units 95% of the time to comply with the SWTR, so credit can be given by default for 2-log removal of viruses & Crypto and 2.5-log removal of Giardia. Free chlorine, chloramination, and UV disinfection must then attain the remaining 2-log inactivation of viruses, 0.5-log inactivation of Giardia, and 1.5-log of Crypto.

The membrane system is required to achieve <0.15 turbidity units 95% of the time to comply with the SWTR, so credit can be given by default for 2-log removal of viruses, 3-log inactivation of Giardia, and 2-log inactivation of Crypto. Free chlorine must achieve the remaining 2-log of viruses. Maintaining membrane integrity must achieve the remaining 1.5-log inactivation of Crypto.

MEMBRANE INTEGRITY TESTING (MIT) MUST BE COMPLETED EVERY 24 HOURS, PER THE CFR. IF THE TRAIN FAILS MIT, IT MUST BE TAKEN OFFLINE UNTIL IT PASSES. IF TRAIN TURBIDITIES EXCEED 0.15 NTU, THAT TRAIN *MUST* BE TAKEN OFFLINE UNTIL IT PASSES MIT.

**THE CONVENTIONAL SIDE OF THE PLANT HAS 4 FILTERS ONLINE AND THE MEMBRANE SIDE OF THE PLANT HAS 2 TRAINS THAT CONSISTENTLY PASS MIT. CAPACITY OF THE PLANT HAS BEEN LOWERED TO REFLECT WHAT THE PLANT CAN ACTUALLY TREAT. EACH SIDE WAS RATED AT 25 MGD.

25 MGD / 6 (FILTERS & TRAINS) = 4.2 MGD/FILTER OR TRAIN

CONVENTIONAL: 4.2 MGD * 4 FILTERS = 16.8 MGD
MEMBRANE: 4.2 MGD * 2 TRAINS = 8.4 MGD

TOTAL PLANT CAPACITY: 25.2 MGD

CT CALCULATIONS WILL REMAIN AT MAX CAPACITY OF 25 MGD

Book values:
CT required for 0.5-log inactivation of giardia at 10C and pH at 6.5 = 19 mg/L min
CT required for 2-log inactivation of viruses at 10C and pH at 6.5 = 3 mg/L min

The clearwell is divided into two separate zones based on their baffling. The conventional and membrane treatment trains feed mirror image clearwells, so the T and CT values below apply to each treatment process.

Zone 1:
Volume = 1.989 MG; BF = 0.7
T = [(1.989 MG / 25 MGD)*0.7] * 1440 min/day = 80.2 min @ 25 MGD

Zone 2:
Volume = 1.658 MG; BF = 0.3
T = [(1.658 / 25 MGD)*0.3] * 1440 min/day = 28.7 min @ 25 MGD

Total T = 80.2 + 28.7 = 108.9 min

The free chlorine residual measured from High Service 1 (conventional side) finished water = 0.1 mg/L

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Ct25 = 0.1 mg/l * 108.9 minutes = 10.89 mg/L min

Virus inactivation achieved at 0.1 mg/L free chlorine at 25 MGD;
10.89 mg/L min > 3 mg/L min

Giardia log inactivation = 10.89 mg/L min / 19 mg/L min * (0.5) = 0.29 log
Remaining 0.5-log Giardia inactivation not achieved by free chlorine contact time in clearwell.

UV disinfection - UV unit attached to each filter
Each UV unit must be dosing a minumum of 4 mJ/sq.cm. to achieve the final 1.5-log removal of Crypto and the remaining 0.21-log removal of Giardia.

IF AT ANY TIME A UV UNIT IS OUT OF SERVICE, THE CORRESPONDING FILTER MUST BE TAKEN OUT OF SERVICE. CRYPTO AND GIARDIA REMOVAL IS NOT ACHIEVED WITHOUT UV DISINFECTION

Full CT credit for the conventional side at maximum treatment capacity of 25 MGD can be given, so full CT credit at decreased capacity of 16.8 MGD can be given.

The free chlorine residual measured from High Service 2 (membrane side) finished water = 0.2 mg/L.

Using this minimum concentration throughout the clearwell and flow rate of 25 MGD, the contact time is:
T = 108.9 min
CT = 0.2 mg/L * 108.9 minutes = 21.78 mg/L min

Virus inactivation achieved at 0.3 mg/L free chlorine at 25 MGD;
21.78 mg/L min > 3 mg/L min

Giardia & Crypto log inactivation achieved by maintaining turbidities <0.15 NTU 95% of the time. Any time turbidities exceed 0.15 NTU, that train must be taken offline.

Full CT credit for the membrane side at maximum treatment capacity of 25 MGD can be given, so full CT credit at decreased capacity of 8.4 MGD can be given.

Treatment capacity is not limited on either side by CT.

TOTAL TREATMENT CAPACITY AT OB CURTIS = Conventional (16.8 MGD) + Membrane (8.4 MGD)
= 25.2 MGD

*** OB CURTIS DESIGN CAPACITY ***
Raw water pump capacity = (9+8+9+8+8+17+8+17) MGD = 84 MGD
Rated treatment capacity of plant = 25.2 MGD (limiting factor)
Service pump capacity = (8+8+12+12+12+16+16+22+22) = 128 MGD
Total storage located at the plant (clearwell capacity) = 10 MG
Usable storage (volume filled in 6 hours) = 25.2 MGD/24 hrs/day x 6 hrs = 6.3 MG
Total plant capacity = rated treatment capacity of plant + usable storage/200 minutes
Total plant capacity = 25.2 MGD + (6.3 MG/200min * 1440 min/day) = 70.56 MGD
This does not exceed the service pump capacity of 128 MGD, so:
OB CURTIS DESIGN CAPACITY = 70.56 MGD

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TOTAL SYSTEM DESIGN CAPACITY

TOTAL CAPACITY OF FEWELL AND OB CURTIS PLANTS = 20 MGD + 70.56 MGD = 90.56 MGD
90,560,000 gpd / 1440 min/day = 62,889 CONNECTIONS

TOTAL ELEVATED STORAGE ON SYSTEM:
0.5 MG + 0.2 + 1.0 + 0.5 + 1.5 + 1.0 + 0.5 + 1.0 + 1.0 + 0.25 + 1.5 = 8.95 MG
*1.0 MG Byram tank taken out of calculations due to being offline

FINAL DESIGN CAPACITY FOR ENTIRE SYSTEM:
Final design capacity = 62,889 + (8,950,000 gal/200 min) = 107,639 CONNECTIONS

EQUIVALENT CONNECTIONS CALCULATIONS:

COMMERCIAL/INDUSTRIAL USAGE FACTOR CALCULATIONS:
Ciu = Average total CI use(gal)/avg total use (gal)
The Ciu factor calculated from 2019 data = 0.5
Number of Actual Connections = 54,679
Apartment Adjusted = # Units X 2/3 = 19,407 x 2/3 = 12,938
Total Adjusted Connections = Actual + Apartment Adjusted
= 54,679 + 12,938 = 67,617

Eq. connections = # of adjusted conn + (# of adjusted conn x Ciu factor x 0.5)
= 67,617 + (67,617 x 0.5 x 0.5)
= 84,521

Total final equivalent connections = 84,521

THEREFORE THIS SYSTEM IS CURRENTLY AT 84,521/107,639 = 78% CAPACITY.