



FULL LIFE. FULL FORWARD.
FLORENCE
SOUTH CAROLINA

August 16, 2024 Low Water Pressure Event and Response

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Utility Operations Director

August 21, 2024

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Section 1 - Timeline of Events

Thursday, August 15

7:00 pm	Operator A comes on shift. The Surface Water Treatment Plant (SWTP) was operating normally except for 3 of the 6 filters had started to Filter-to-Waste (FTW) in the 3 hours prior – signs of high turbidity in the raw water from the on-site reservoir
7:00 pm - 8:00 pm	The remaining 3 filters automatically go FTW when turbidity reaches .3 NTU. The plant is no longer producing new water, but the finish water pumps are still pushing water to the distribution system from the clearwell at a rate of 3.5 million gallons per day (MGD)
8:30 pm	Operator A telephones a more experienced operator (Operator B) to request advice. Operator B recommends continuing to FTW and watch the turbidity readings. Normally the filters would slowly recover and begin to filter normally in 4-6 hours
8:40 pm	Operator A checks the flocculant (ferric) feed into raw water and shuts off lime and fluoride
9:30 pm – 10:00 pm	Operator A observed filter turbidity rise instead of falling as expected
10:00 pm – 10:30 pm	Operator A ran routine finish water samples
11:00 pm – 1:00 am	Operator A recorded tank levels and observed filter turbidity levels drop very slowly

Friday, August 16

1:00 am – 1:30 am	Operator A ran routine samples
2:00 am	Operator A recorded tank levels

Friday, August 16

- 2:20 am** Operator A observed the clearwell level getting low and observed it auto-shut off at 8 ft. The SWTP is no longer producing new water or pushing water to the distribution system.
- 2:30 am** Operator A telephones a more experienced operator (Operator C) to request advice. Operator C suggested trying to exercise the filter drain valves and to go downstairs to clean the turbidity meter valves. Operator A executed the suggestions but there was no improvement in filter turbidity.
- 3:00 am** Operator A called Operator C back, and he recommended telephoning the Water Manager (Water Supervisor was on approved leave). Operator A was not able to reach Water Manager, so he called Operator C again, who recommended a ferric jar test to test chemical doses. Operator A was not trained to complete the jar test and was not able to complete it. Operator C recommended shutting off the raw water pumps at the river to stop the feed to the reservoir.
- 3:30 am** Operator A attempted to try the filter drain valves again and recorded tank levels
- 3:50 am – 5:30 am** Operator A attempted unsuccessfully to reach Water Manager on the telephone. Operator A continued to try the filter drain valves, observed the filters, but the filter turbidity was no longer dropping
- 5:30 am – 6:00 am** Water manager telephoned to say he was on the way. Operator A completed routine lab meter calibration.
- 6:00 am** Operator D arrived for shift, he was briefed by Operator A
- 6:30 am** Water Manager arrived at SWTP. Decision was made to turn river pumps and chemical feeds back on to feed the plant directly from the river
- 6:49 am** Water Manager text messaged Utility Operations Director. Director responded to Water Manager. Texts did not relay any information indicating operational issues at the SWTP.

Friday, August 16

7:20 am

Operator A checked river turbidity levels, SWTP operators began the process of draining sedimentation basins to remove excessively turbid water

9:00 am

Operator C arrived at SWTP and began running ferric jar tests to determine chemical feeds for new source water directly from the river

9:00 am – 10:30 am

Operators drain sedimentation basins, and run water to the filters, and opened drain valves. Operators make chemical feed adjustments based on jar tests and adjust rapid mix and FLOC. Begin filling 1 basin to run new water to filters.

10:30 am

Public Works begins to receive heavy call volume reporting low water pressures in the area primarily served by the SWTP.

10:31 am

Water Manager and Public Works administrative staff telephone the Utility Operations Director to inform him of system pressure issues during a meeting with a local business and about a private plumbing sewer issue.

10:30 am – 3:00 pm

SWTP operators run more jar tests, check basins and monitor filters as they progress to the point where they reach the turbidity target of less than .3 NTU. At this point it no longer FTW and water can begin to filter through to the clearwell.

10:45 am

City Manager, Scotty Davis directed Utility Operations Director, Utilities Planning and Economic Development Director and Distribution Superintendent to set up headquarters at Public Works to monitor system pressures, contact and communicate with sensitive/major water customers, make operational decisions, and coordinate resources to be in a position to regain system pressure as safely and quickly as possible.

11:30 am

Water Production operators began closing elevated tanks so that water pressure would rebound in the system more rapidly.

Friday, August 16

12:23 pm

The City of Florence issued a press release detailing the city-wide low water pressure situation and issued a boil-water advisory upon the system regaining pressure.

2:30 pm – 6:45 pm

System water pressures slowly rise through the afternoon and early evening.

6:45 pm

SWTP Clearwell reaches 10 feet. Operators turn on finish water pumps at a low rate to begin pushing water to the distribution system. Within 10 minutes, system pressures begin to rise more rapidly.

8:30 pm

SWTP output increases, system water pressures reach normal levels.

**8:30 pm - Saturday
(August 17th), and
Sunday (August 18th)**

SWTP back to normal operation, elevated tanks brought back online sequentially to reach overall water system volume and stability. Samples collected, samples processed and analyzed, boil-water advisory repealed.

Section 2 – Boil-Water Advisory

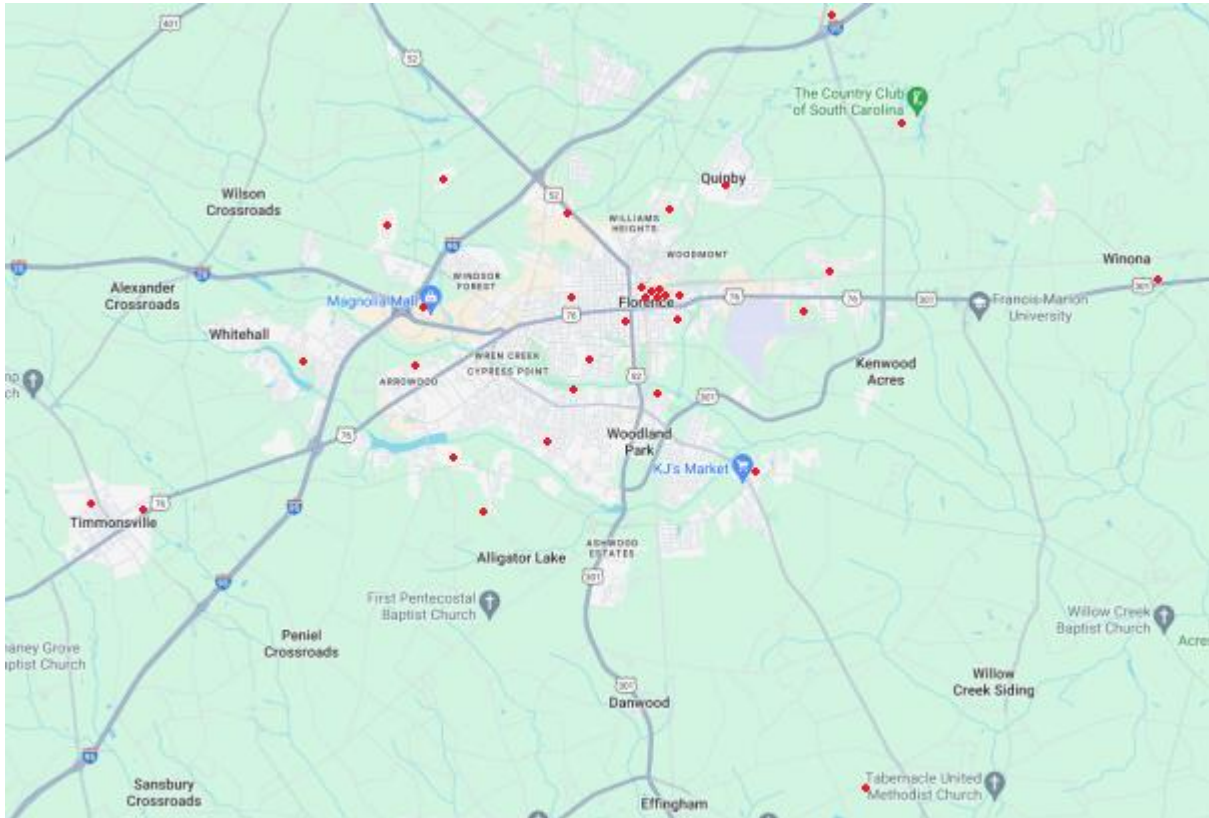
The City developed a policy of issuing a boil-water advisory (BWA) any time the water system reaches a low/no pressure situation. This policy goes beyond the Department of Environment Services (DES) requirement, which mandates issuing a BWA only when a significant number of customers are affected by low/no pressure. Typically, boil-water advisories (BWAs) are issued due to water line damage caused by contractor work or environmental conditions, and are confined to a small percentage of system users. However, in the case of the events of August 16, 2024, the loss of pressure system-wide necessitated a system-wide BWA.

Upon testing, there was no confirmed bacteriological contamination of the water system. Also, residual chlorine levels remained consistent. The BWA was issued until the City could complete bacteriological sampling, as required by DES, to verify the absence of harmful bacteria.

Typically, bacteriological sampling will occur after the system has re-stabilized the same day. In the case of August 16th, 2024, the decision was made to conduct most of the sampling the following day during daylight hours, rather than at night, to reduce the potential for errors. Samples were collected and processed, then incubated for 18 hours as required. Samples were negative for total coliform and E. Coli. The BWA was repealed midday on Sunday, August 18, 2024. See Sections 3, 4 and 5 for more information on sampling and sample analysis.

Section 3 – Water Sampling Summary, Sampling Locations and Results

Sampling locations were selected across the entire Florence water system. The red dots on the map below indicate sampling locations. Specific addresses are notated on the forms in Section 4 – Chain-of-Custody forms and Sample results.



Section 4 – Chain-of-Custody Forms and Sample Results

The following bacterial analysis sample chain-of-custody forms and sample result forms show all the samples had acceptable residual chlorine and were negative for Total Coliform and E. Coli.

City of Florence
 Pee Dee River Regional Water Treatment Plant
 Total Coliform Bacteria and E. Coli in Drinking Water
Colilert -18

Lab ID#: 21903 // EPA Lab ID: SC01278
 System ID Number: 2110001

SM 9223 B -2004
 A=Absent P= Presence

Waterbath set up date: <u>8-17-24</u>		Waterbath set up time: <u>1746</u>		Waterbath temp.(°C): <u>44.5°C</u>		Analyst: <u>SM</u>					
Sample (s) transferred to the Incubator (Time): <u>1752</u>		Incubator Temperature (°C): <u>35.0°C</u>		Analyst: <u>SM</u>							
Sample Information		Biochemical Reactions						Reported Test Results			
Sample ID#	Location	Color Change after 18 hours		Color Change after 22 hours		Fluorescence		Total Coliform		E. Coli	
		Y	N	Y	N	Y	N	P	A	P	A
081724704A	1304 N. Darlington Str.	Y	N	Y	N	Y	N	P	A	P	A
081724704B	Lucas Street (Tank)	Y	N	Y	N	Y	N	P	A	P	A
081724704C	180 N. B. Borsdy Str.	Y	N	Y	N	Y	N	P	A	P	A
081724704D	1203 E. Cheves Str.	Y	N	Y	N	Y	N	P	A	P	A
081724704E	635 Ashby Rd.	Y	N	Y	N	Y	N	P	A	P	A
081724704F	3105 Grey Stone	Y	N	Y	N	Y	N	P	A	P	A
081724704G	3410 Terryson Ct.	Y	N	Y	N	Y	N	P	A	P	A
081724704H	3908 W. Lake Dr.	Y	N	Y	N	Y	N	P	A	P	A
081724704I	3000 Bonwood Pr.	Y	N	Y	N	Y	N	P	A	P	A
081724704J	3040 Prokators Pr.	Y	N	Y	N	Y	N	P	A	P	A
081724704K	2466 Easy Street	Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A

Container Lot #: MW008V // Exp. Date: 10-03-26

Colilert-18 Lot#: AY424 // Exp: 01-Jun-2025

Waterbath Thermometer SN: 1272

Test results recorded by: Scott Miller

Date / Time : 8-18-24 / 1155

Incubator Temp (°C): 35.0°C

* Sample Volume is 100 mL unless different volume is specified

* Incubator temperature range: 35.0 °C ± 0.5 °C

* Waterbath temperature range: 44.3 °C - 44.7 °C

***Yellow color yields a **POSITIVE** Total Coliform result

***Yellow color & Fluorescence yields a **POSITIVE** E. Coli result

Waterbath SN# 9504-106 / Incubator SN: 207NO158

Colilert / Colilert-18 PA Comparator Lot#: JW772 / EXP: 28-Sep-2024

Rev. 02/06/2024 (SWTP/BT)

CITY OF FLORENCE
Pee Dee Regional Water Treatment Plant

Rev. 02/03/2022 BT

CHAIN OF CUSTODY										
Collected By: ALLEN DAVIS					Sample Location: SYSTEM-DISTRIBUTION			Station: Water Production		
Sampler (Signature): <i>Allen Davis</i>					Port: Colorimeter Serial Number: 160320001051			Lab ID #: 21003 // Initial: A.D.		
								Regulatory: <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		
DATE	Operator Sample ID #	SAMPLE ID #	LOCATION	Sample Time	# of containers	Type of container	Grab	Chlorine Res. (ppm)	Analysis Required	Relinquished By: DATE / TIME
08-17-2024	704A	081724704A	1304 N. DARLINGTON STREET	11:20 A.M.	01	Plastic	✓	0.56	TC	Relinquished By: <i>Allen Davis</i> 08/17/24 5:30 PM
08-17-2024	704B	081724704B	LUCAS STREET (TANK)	12:30 P.M.	01	Plastic	✓	1.36	TC	Received By: <i>Scott Hill</i> 8-17-24 1730
08-17-2024	704C	081724704C	180 N.B. BARODY STREET	1:00 P.M.	01	Plastic	✓	0.20	TC	Relinquished By: DATE / TIME
08-17-2024	704D	081724704D	1203 E. CHEVES STREET	1:20 P.M.	01	Plastic	✓	0.20	TC	Received By: DATE / TIME
08-17-2024	704E	081724704E	635 ASHBY ROAD	1:58 P.M.	01	Plastic	✓	0.25	TC	DPD Lot: A4060 // Exp. Date: MARCH-2024
08-17-2024	704F	081724704F	3105 GREY STONE	2:35 P.M.	01	Plastic	✓	0.36	TC	
08-17-2024	704G	081724704G	3410 TENNYSON COURT	2:58 P.M.	01	Plastic	✓	0.95	TC	Bottle Lot #: MW008V // Exp. Date: OCT. 03, 2026
08-17-2024	704H	081724704H	3908 W. LAKE DRIVE	3:28 P.M.	01	Plastic	✓	1.18	TC	Ident. Bottle preserved w/ Sodium Thiosulfate
08-17-2024	704I	081724704I	3000 BOXWOOD DRIVE	4:00 P.M.	01	Plastic	✓	0.97	TC	ICED: <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
08-17-2024	704J	081724704J	3040 DRAKESHORE DRIVE	4:20 P.M.	01	Plastic	✓	0.96	TC	Temperature upon receipt: Thermometer SN: 6.8 1272
08-17-2024	704K	081724704K	2466 EASY STREET	4:45 P.M.	01	Plastic	✓	0.95	TC	Program Area: Drinking Water
					01	Plastic	✓		TC	Comments:
					01	Plastic	✓		TC	
					01	Plastic	✓		TC	

TC: Total Coliform // EC: E. Coli

City of Florence
 Pee Dee River Regional Water Treatment Plant
Total Coliform Bacteria and E. Coli in Drinking Water
Colilert -18

Lab ID#: 21903 // EPA Lab ID: SC01278
 System ID Number: 2110001

SM 9223 B -2004
 A=Absent P= Presence

Waterbath set up date: 08-16-24 Waterbath set up time: 2144 Waterbath temp.(°C): 44.5° Analyst: [Signature]
 Sample (s) transferred to the Incubator (Time): 2200 Incubator Temperature (°C): 35.0° Analyst: [Signature]

Sample Information		Biochemical Reactions						Reported Test Results			
Sample ID#	Location	Color Change after 18 hours		Color Change after 22 hours		Fluorescence		Total Coliform		E. Coli	
		Y	N	Y	N	Y	N	P	A	P	A
<u>081624BUCCUS</u>	<u>BUCCUS</u>	Y	<u>(N)</u>	Y	N	Y	<u>(N)</u>	P	<u>(A)</u>	P	<u>(A)</u>
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A

Container Lot #: AY4EM M4006V // Exp. Date: ~~01-Jun-2025~~ 10-03-26 BT 8-17-24
 Colilert-18 Lot#: AY424 // Exp: 01-Jun-2025
 Waterbath Thermometer SN: 1272

* Sample Volume is 100 mL unless different volume is specified
 * Incubator temperature range: 35.0 °C ± 0.5 °C
 * Waterbath temperature range: 44.3 °C - 44.7 °C
 ***Yellow color yields a **POSITIVE** Total Coliform result
 ***Yellow color & Fluorescence yields a **POSITIVE** E. Coli result

Test results recorded by: [Signature]
 Date / Time : 8-17-24 / 1710
 Incubator Temp (°C): 35.0°C

Waterbath SN* 9504-106 / Incubator SN: 207NO158
 Colilert / Colilert-18 PA Comparator Lot#: JW772 / EXP: 28-Sep-2024

Rev. 02/06/2024 (SWTP/BT)

City of Florence
 Pee Dee River Regional Water Treatment Plant
Total Coliform Bacteria and E. Coli in Drinking Water
Colilert -18

Lab ID#: 21903 // EPA Lab ID: SC01278
 System ID Number: 2110001

SM 9223 B -2004
 A=Absent P= Presence

Waterbath set up date: 08-17-24 Waterbath set up time: 1600 Waterbath temp.(°C): 44.3 Analyst: KWJ
 Sample (s) transferred to the Incubator (Time): 1609 Incubator Temperature (°C): 35.0 Analyst: KWJ

Sample Information		Biochemical Reactions						Reported Test Results			
Sample ID#	Location	Color Change after 18 hours		Color Change after 22 hours		Fluorescence		Total Coliform		E. Coli	
		Y	N	Y	N	Y	N	P	A	P	A
081724-A	3203 MIDDLECOFF LN	Y	N	Y	N	Y	N	P	A	P	A
081724-B	6515 E. PALMETTO ST	Y	N	Y	N	Y	N	P	A	P	A
081724-C	3204 SKYLANE DR	Y	N	Y	N	Y	N	P	A	P	A
081724-D	297 GREER RD	Y	N	Y	N	Y	N	P	A	P	A
081724-E	317 S. IRBIL ST	Y	N	Y	N	Y	N	P	A	P	A
081724-F	1321 S. EDISTO DR	Y	N	Y	N	Y	N	P	A	P	A
081724-G	961 S. PARK AVE	Y	N	Y	N	Y	N	P	A	P	A
081724-H	2609 SPRING ST	Y	N	Y	N	Y	N	P	A	P	A
081724-I	453 SIESTA DR	Y	N	Y	N	Y	N	P	A	P	A
081724-K	1913 W. WESTMORELAND AVE	Y	N	Y	N	Y	N	P	A	P	A
081724-L	2791 DAVID McLEOD BLVD	Y	N	Y	N	Y	N	P	A	P	A
081724-M	755 E. SMITH ST	Y	N	Y	N	Y	N	P	A	P	A

Container Lot #: MW1008V // Exp. Date: 10-03-26

Colilert-18 Lot#: A4424 // Exp: 01 JUN 25

Waterbath Thermometer SN: 1272

Test results recorded by: SWT mlk

Date / Time : 8-18-24 / 1024

Incubator Temp (°C): 35.0°C

* Sample Volume is 100 mL unless different volume is specified

* Incubator temperature range: 35.0 °C ± 0.5 °C

* Waterbath temperature range: 44.3 °C - 44.7 °C

***Yellow color yields a **POSITIVE** Total Coliform result

***Yellow color & Fluorescence yields a **POSITIVE** E. Coli result

Waterbath SN* 9504-106 / Incubator SN: 207NO158

Colilert / Colilert-18 PA Comparator Lot#: JW772 / EXP: 28-Sep-2024

Rev. 02/06/2024 (SWTP/BT)

City of Florence
Pee Dee River Regional Water Treatment Plant
Total Coliform Bacteria and E. Coli in Drinking Water
Colilert -18

Lab ID#: 21903 // EPA Lab ID: SC01278
System ID Number: 2110001

SM 9223 B -2004
A=Absent P= Presence

Waterbath set up date: 08-17-24 Waterbath set up time: 1600 Waterbath temp.(°C): 44.3 Analyst: KWJ
Sample (s) transferred to the Incubator (Time): 1609 Incubator Temperature (°C): 35.0 Analyst: KWJ

Sample Information		Biochemical Reactions						Reported Test Results			
Sample ID#	Location	Color Change after 18 hours		Color Change after 22 hours		Fluorescence		Total Coliform		E. Coli	
		Y	N	Y	N	Y	N	P	A	P	A
081724-N	702 BROCKINGTON ST	Y	(N)	Y	N	Y	(N)	P	(A)	P	(A)
081724-P	3208 LEBANON RD	Y	(N)	Y	N	Y	(N)	P	(A)	P	(A)
081724-Q	1009 E. PINE ST	Y	(N)	Y	N	Y	(N)	P	(A)	P	(A)
081724-R	234 E. SHERMANOAK LN	Y	(N)	Y	N	Y	(N)	P	(A)	P	(A)
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A

Container Lot #: MW1008V // Exp. Date: 10-03-26
Colilert-18 Lot#: A4424 // Exp: 01 JUNE 25
Waterbath Thermometer SN: 1272

* Sample Volume is 100 mL unless different volume is specified
* Incubator temperature range: 35.0 °C ± 0.5 °C
* Waterbath temperature range: 44.3 °C - 44.7 °C
***Yellow color yields a **POSITIVE** Total Coliform result
***Yellow color & Fluorescence yields a **POSITIVE** E. Coli result

Test results recorded by: Seth Gule
Date / Time : 8-18-24 / 1024
Incubator Temp (°C): 35.0°C

Waterbath SN# 9504-106 / Incubator SN: 207NO158
Collert / Collert-18 PA Comparator Lot#: JW772 / EXP: 28-Sep-2024

Rev. 02/06/2024 (SWTP/BT)

CITY OF FLORENCE
Pee Dee Regional Water Treatment Plant

Rev. 02/03/2022 BT

CHAIN OF CUSTODY										
Collected By: <i>Ken Williams</i> Sampler (Signature)				Sample Location: SYSTEM WIDE Pacostat Colibrator Serial Number: 231003001481				Station: Water Production Lab ID #: 21003 // Initial: KW		
								Regulatory: <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		
DATE	Operator Sample ID #	SAMPLE ID #	LOCATION	Sample Time	# of containers	Type of container	Grab	Chlorine Res. (ppm)	Analysis Required	Relinquished By: DATE / TIME
08-17-24	703-A	081724-A	3203 MIDDECOFF LN	0944	01	Plastic	✓	0.51	TC EC	Received By: <i>Ken Williams</i> 08-17-24/1540
08-17-24	703-B	081724-B	6515 E. PALUETTO ST	1005	01	Plastic	✓	0.54	TC EC	Received By: <i>Ken Williams</i> 08-17-24/1540
08-17-24	703-C	081724-C	3204 SKYLINE DR	1023	01	Plastic	✓	0.52	TC EC	Relinquished By: DATE / TIME
08-17-24	703-D	081724-D	297 GREER RD	1032	01	Plastic	✓	0.49	TC EC	Received By: DATE / TIME
08-17-24	703-E	081724-E	317 S. IRBY ST	1046	01	Plastic	✓	0.48	TC EC	DPD Lot <i>A460</i> // Exp. Date: <i>Mar 29</i>
08-17-24	703-F	081724-F	1321 S. EDISTO DR	1101	01	Plastic	✓	0.46	TC EC	
08-17-24	703-G	081724-G	961 S. PARK AVE	1114	01	Plastic	✓	0.51	TC EC	Bottle Lot #: <i>M14068V</i> // Exp. Date: <i>10-03-26</i>
08-17-24	703-H	081724-H	2609 SPRING ST	1142	01	Plastic	✓	0.49	TC EC	<i>Idea</i> Bottle preserved w/ Sodium Thiosulfate
08-17-24	703-I	081724-I	453 SIESTA DR	1158	01	Plastic	✓	0.65	TC EC	ICED: <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
08-17-24	703-K	081724-K	1913 W. WESTMORELAND AVE	1219	01	Plastic	✓	0.49	TC EC	Temperature upon receipt: <i>1.4°C</i> Thermometer SN: <i>1272</i>
08-17-24	703-L	081724-L	2791 DAVID McLEOD BLVD	1320	01	Plastic	✓	0.52	TC EC	Program Area: Drinking Water
08-17-24	703-M	081724-M	755 E. SMITH ST	1356	01	Plastic	✓	0.91	TC EC	Comments: <i>PAGE 1 of 2</i>
08-17-24	703-N	081724-N	702 BROOKINGTON ST	1410	01	Plastic	✓	0.89	TC EC	
08-17-24	703-P	081724-P	3208 LEBANON RD	1439	01	Plastic	✓	0.54	TC EC	

TC: Total Coliform // EC: E. Coli

CITY OF FLORENCE
Pee Dee Regional Water Treatment Plant

Rev. 02/03/2022 BT

CHAIN OF CUSTODY

Collected By: <u>Ken Williams</u>					Sample Location: <u>System Wide</u>			Station: Water Production		
Sampler (Signature): <u>[Signature]</u>					Pocket Colorimeter Serial Number: <u>231003001481</u>			Lab ID #: 21803 / Initial: <u>KW</u>		
								Regulatory: <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		
DATE	Operator Sample ID #	SAMPLE ID #	LOCATION	Sample Time	# of containers	Type of container	Grab	Chlorine Res. (ppm)	Analysis Requested	Relinquished By: DATE / TIME
08-17-24	703-Q	081724-Q	1009 E. PINE ST	1501	01	Plastic	✓	0.40	TC EC	Relinquished By: <u>Ken Williams</u> 08-17-24/1546 Received By: <u>Ken Williams</u> 08-17-24/1546
08-17-24	703-R	081724-R	234 E. SHEPARD LN	1522	01	Plastic	✓	0.31	TC EC	Relinquished By: _____ DATE / TIME Received By: _____ DATE / TIME
					01	Plastic	✓		TC EC	Relinquished By: _____ DATE / TIME Received By: _____ DATE / TIME
					01	Plastic	✓		TC EC	DPD Lot: <u>A4060</u> // Exp. Date: <u>MAR29</u>
					01	Plastic	✓		TC EC	Bottle Lot #: <u>MUK084</u> Exp. Date: <u>10-03-26</u>
					01	Plastic	✓		TC EC	Iceux Bottle preserved w/ Sodium Thiosulfate
					01	Plastic	✓		TC EC	ICED: <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
					01	Plastic	✓		TC EC	Temperature upon receipt: _____ Thermometer SN: <u>1272</u> <u>1.4°C</u>
					01	Plastic	✓		TC EC	Program Area: Drinking Water
					01	Plastic	✓		TC EC	Comments: <u>PAGE 2 of 2</u>
					01	Plastic	✓		TC EC	
					01	Plastic	✓		TC EC	

TC: Total Coliforms // EC: E. Coli

City of Florence
 Pee Dee River Regional Water Treatment Plant
Total Coliform Bacteria and E. Coli in Drinking Water
Colilert -18

Lab ID#: 21903 // EPA Lab ID: SC01278
 System ID Number: 2110001

SM 9223 B -2004
 A=Absent P= Presence

Waterbath set up date: 08-18-24 Waterbath set up time: 1528 Waterbath temp.(°C): 44.3 Analyst: KW
 Sample (s) transferred to the incubator (Time): 1537 Incubator Temperature (°C): 35.0 Analyst: KW

Sample Information		Biochemical Reactions						Reported Test Results			
Sample ID#	Location	Color Change after 18 hours		Color Change after 22 hours		Fluorescence		Total Coliform		E. Coli	
		Y	N	Y	N	Y	N	P	A	P	A
081824-A	McLEOD MEDICAL PARK #5	Y	N	Y	N	Y	N	P	A	P	A
081824-B	McLEOD DAY HOSP ENTRANCE	Y	N	Y	N	Y	N	P	A	P	A
081824-C	McLEOD OLD ER ENTRANCE	Y	N	Y	N	Y	N	P	A	P	A
081824-D	McLEOD ER ENTRANCE	Y	N	Y	N	Y	N	P	A	P	A
081824-E	McLEOD MEDICAL PLAZA	Y	N	Y	N	Y	N	P	A	P	A
081824-F	McLEOD MED PARK SOUTH	Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A
		Y	N	Y	N	Y	N	P	A	P	A

Container Lot #: MW008V // Exp. Date: 10-03-26
 Colilert-18 Lot#: A4424 // Exp: 01 June 25
 Waterbath Thermometer SN: 1272

Test results recorded by: BT
 Date / Time : 8-19-24/0937
 Incubator Temp (°C): 34.5

* Sample Volume is 100 mL unless different volume is specified
 * Incubator temperature range: 35.0 °C ± 0.5 °C
 * Waterbath temperature range: 44.3 °C - 44.7 °C
 ***Yellow color yields a **POSITIVE** Total Coliform result
 ***Yellow color & Fluorescence yields a **POSITIVE** E. Coli result

Waterbath SN# 9504-106 / Incubator SN: 207NO158
 Colilert / Colilert-18 PA Comparator Lot#: JW772 / EXP: 28-Sep-2024

Rev. 02/06/2024 (SWTP/BT)

CITY OF FLORENCE
Pee Dee Regional Water Treatment Plant

Rev. 02/03/2022 BT

CHAIN OF CUSTODY

Collected By: <u>Ken Williams</u>		Sample Location: <u>McLEOD HEALTH</u>		Station: <u>Water Production</u>						
Sampler (Signature): <u>[Signature]</u>		Facility Colorimeter Serial Number: <u>231008001481</u>		Lab ID #: <u>21903</u> / Initial: <u>KW</u>						
DATE	Operator Sample ID #	SAMPLE ID #	LOCATION	Sample Time	# of containers	Type of container	Grab	Chlorine Res. (ppm)	Analysis Required	Relinquished By: <u>Ken Williams</u> DATE / TIME: <u>08-18-24 / 1510</u>
08-18-24	703-A	081824-A	McLEOD MEDICAL PARK #5	1327	01	Plastic	✓	0.63	TC EC	Received By: <u>Ken Williams</u> DATE / TIME: <u>08-18-24 / 1510</u>
08-18-24	703-B	081824-B	McLEOD Day Hosp ENTRANCE	1344	01	Plastic	✓	0.81	TC EC	
08-18-24	703-C	081824-C	McLEOD OLD ER ENTRANCE	1402	01	Plastic	✓	0.62	TC EC	Relinquished By: _____ DATE / TIME: _____
08-18-24	703-D	081824-D	McLEOD ER ENTRANCE	1416	01	Plastic	✓	0.77	TC EC	Received By: _____ DATE / TIME: _____
08-18-24	703-E	081824-E	McLEOD MED PLAZA	1424	01	Plastic	✓	0.69	TC EC	DPD Lot <u>A4060</u> // Exp. Date: <u>Mar 21</u>
08-18-24	703-F	081824-F	McLEOD MED PARK SOUTH	1439	01	Plastic	✓	0.38	TC EC	
					01	Plastic	✓		TC EC	Bottle Lot # <u>MUK608V</u> // Exp. Date: <u>10-03-26</u>
					01	Plastic	✓		TC EC	Icez Bottle preserved w/ Sodium Thiosulfate
					01	Plastic	✓		TC EC	ICED: <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
					01	Plastic	✓		TC EC	Temperature upon receipt: <u>2.1°C</u> Thermometer SN: <u>1272</u>
					01	Plastic	✓		TC EC	Program Area: <u>Drinking Water</u>
					01	Plastic	✓		TC EC	Comments:
					01	Plastic	✓		TC EC	
					01	Plastic	✓		TC EC	

TC: Total Coliform // EC: E. Coli

Section 5 – Laboratory SOPs for Bacteriological Analysis

The City of Florence SWTP bacteriological analysis laboratory SOPs, QA/QC and sample evaluation procedures are outlined in the document below.

City of Florence, SC
Pee Dee Regional Water Treatment Plant

SC Lab ID#: 21903
EPA Lab ID#: SC01278

Standard Operating Procedure

IX. Total Coliform / E.Coli

SM 9223 B – 2004
(Enzyme Substrate)
(Colilert)

Prepared By: Ben Tedder
Laboratory Director
(Rev. 12/29/2021)

A. Scope and Application:

The enzyme substrate test utilizes hydrolysable substrate for the simultaneous detection of Total coliform bacteria and E.Coli. This qualitative analysis is recommended for the determination of total coliform and E.Coli in drinking water and source water. This method is used at the Surface Water Treatment Plant for the detection of total coliform and E. coli on finished water and Clearwell sample, Distribution samples, water main breaks and wells.

B. Summary of Method:

A 100 ml water sample (Finished water, Clearwell) will be collected in a sterile, transparent, non fluorescent borosilicate vessel manufacturer by IDEXX that has been preserved with sodium thiosulfate ($\text{Na}_2\text{S}_2\text{O}_3$). Add the content of a colilert reagent and shake bottle. Incubate sample for 24 hours at 35 ± 0.5 °C.

C. Definitions and abbreviations:

1. Coliform: a group of bacteria found in intestines of warm-blooded animals (including humans) and also in plant, soil, air and water. Fecal coliform area specific class of bacteria which only inhabit the intestines of warm-blooded animals. The presence of coliform bacteria is an indication that the water is polluted and may contain pathogenic (disease-causing) organism.
2. Grab sample: is a single water sample collected at no specific time. Grab sample will show the water characteristics at the time the sample was taken.
3. CW: Clearwell
4. FW: Finished Water

D. Safety

1. Personal protective equipment:
 - a. Eyes protection: safety glasses
 - b. Skin protection: disposable latex gloves
2. MSDS available in the lab

E. Equipment and supplies

1. Incubator set at 35°C \pm 0.5 °C
2. Long wave length (365 nm) ultraviolet lamp
3. UV viewing cabinet
4. Sterile (100 mL minimum) Non-fluorescent borosilicate transparent water collection vessel or equivalent with
5. Glove
6. Pen
7. Incubator thermometer
8. Color/ Fluorescence comparator P/A (IDEXX cat. #: WP104)
9. Disposable pipettes
10. Dry bath incubator
11. Dry bath incubator thermometer
12. Spore ampules BT sure bioindicator
13. Autoclave (Market Forge Sterilmatic: Model: ST-MEL)
14. Autoclave thermometer
15. Autoclave tape & bags

F. Media

1. Remel Culti-loop – Quality control Culture
 - a. Escherichia Coli (Positive control): Yellow and Fluorescent.
 - b. Pseudomonas Aeruginosa (Negative control): Clear and no-fluorescent.
 - c. Klebsiella Pneumoniae (Positive / Negative control): yellow and no-fluorescent.

G. Reagent and chemical

1. Colilert reagent
2. DI water

H. Media preparation

1. Remove the red sheath and break the loop shaft off from the handle directly into a culture tube containing 10.0 mL of sterile deionized water.
2. Incubate the tube at 35-37°C for 10 to 20 minutes to ensure the black film has completely dissolved from the loop. Shake the tube gently to re-suspend the organism.
3. For *Pseudomonas aeruginosa*, label it as (-); for *Escherichia Coli* (+); for *Klebsiella pneumoniae* (+/-)
4. Place the culture tube in the incubator for 24 hours before using it.
5. Media preparation must be replaced when it expires or every three month.

Note: Write the lot number, expiration date, ATCC, prepared by, and preparation date on each tube.

I. Sterilized Water (DI water)

1. Take 500 mL or 1000 mL beaker and fill it up with DI water and autoclave it for 30 minutes at 121°C.

J. Sample collection and preservation:

1. **To ensure proper sampling, the operator or lab analyst should follow these steps:**
 - a. Make sure your hands are clean and / or wearing gloves. The area where the samples are going to be analyzed should be clean and disinfected as well.
 - b. Water faucets from which sample are to be taken shall be free of aerators, bibs, strainers, hose attachments, and purification devices.
 - c. Collect 100 mL of sample, allowing at least a 1- inch air space to facilitate mixing of the sample by shaking

- d. Due to the fact that the sampling points at the SWTP Lab (Faucet) are opened 24 hours a day, the sampler needs to close the faucet and sterilize it using a propane torch. This is the preferred method. An alternate method is spraying outside and inside of the faucet with alcohol or sodium hypochlorite.
- e. After sterilization, open the faucet fully and let the water run for approximately 2 minutes.
- f. Keep the sample bottle closed until it is to be filled.
- g. Reduce flow and remove seal from sample bottle then open. Fill sample bottle to the 100 ml line leaving approximately 1 inch of space at the top.
Caution: Do Not Overfill! Do not allow the inner part of the cap or bottle to come in contact with the faucet or fingers. Quickly replace and tighten cap.
- h. Sample container: Sterile (100 mL minimum) Non-fluorescent , transparent borosilicate water collection vessel (IDEXX) or equivalent
- i. Sample type: grab

K. Sample preparation and Procedure (Colilert Presence/Absence)

1. Collect 100 mL of sample (finished water / Clearwell) in a sterile, transparent, non-fluorescent vessel.
2. **NOTE: Sample volume analyzed for total coliform and E. Coli in drinking water must be 100 ml. The laboratory must shake the sample vigorously at least 25 times before measuring out the 100 mL to be used for analysis. If a sample bottle is filled to full to allow proper mixing, pour the entire sample into a larger sterile container, mix properly and measure out 100 ml. A 100 mL sample bottle will be use as volume reference in the lab and in the field.**
3. Carefully separate one Pack (Colilert Reagent) from the strip taking care not to accidentally open adjacent pack.
4. Tap the Pack to ensure that all of the colilert powder is in the bottom part of the pack.
5. Open one pack by snapping back the top of the scoreline. **DO not touch** the opening of the pack.
6. Add colilert reagent to 100 mL water sample in a sterile, transparent, non-Fluorescent vessel (100mL).
7. Aseptically cap the vessel.
8. Shake the bottle at least 35 times to make sure the colilert reagent is completely dissolved. If by the end of the 35 count there is still some reagent at the bottom of the bottle, then keep shaking until the reagent is dissolved completely.
9. Incubate prepared sample for 24 hours at 35 °C ±0.5 °C

10. Read the results after 24 hours. Compare each result against the comparator dispensed into an identical vessel.
11. Record your results as Presence (P) or Absence (A) on the Colilert Analysis form.

L. Interpretation of the results

1. If no yellow color is observed on the sample, the test is negative for total coliform.
2. If the sample has a yellow color equal to or greater than the comparator, the present of total coliform is confirmed. Therefore the test is positive for total coliform. If the color is not uniform, mix by inversion then re-check.
3. If the sample is yellow, but lighter than the comparator, it may be incubated an additional 4 hours (but no more than 28 hours total). If the color does not intensify, the sample is negative for total coliform.
4. If sample produces an atypical color change (in the absence of yellow color), laboratory personnel should invalidate the sample, and resample from the same location as the original invalidated sample.
5. If yellow is observed, check vessel for fluorescence by placing it under a 6-watt 365nm UV light within 5 inches of the sample in a dark environment. Be sure the light is facing away from your eyes and toward the vessel. If fluorescence is equal or greater than the comparator, the presence of E. coli is confirmed. Therefore the test is positive for E. coli.

M. Calculation and data reporting

1. Sample collection date and time, sample set up date and time along with operator's initials must be record on the analysis form.
After 24 hours record the sample results: P for presence and A for absence.
Record the analysis date and time along with the operator's initials.
2. If a finished water sample or Clear well water sample tested positive for Total Coliform (yellow), or E. coli. (Yellow & fluorescence), the lab Technician or plant operator shall report the results immediately to the SWTP Superintendent and Utility Director. The Utility Director shall notify DHEC and the City Manager if necessary.
3. Record any phone call made (date and time) to report a positive sample and the name of the person to whom the information was reported.
4. Record any phone call made (date and time) to report a positive sample and the name of the person to whom the information was reported.

N. Autoclaving contaminated material

1. Waste management

- a. All contaminated material is to be placed in the autoclave.
- b. The bottles, quanti-tray and any other contaminated material are then autoclaved for 30 minutes at 121 °C.
- c. After autoclaving is completed, the sample can be disposal in the sink, then it goes out of the lab to the acid waste tank and then it goes to the lagoon.
- d. Place all bottles, disposable pipette and other material that has been autoclaved in a closed garbage bag and transport to the Lee County Landfill.

2. How to run the autoclave

- a. Keep the instrument plugged in (POWER).
- b. Close drain valve by turning handle clockwise
- c. Open the sterilizer door and fill the chamber with 4-6 quarts (3.7-5.6 liters) of ordinary tap water. DO NOT USE DISTILLED OR DIONIZED WATER
- d. **Load Sterilizer:** place all contaminated material on the tray.
- e. Put autoclave thermometer inside the sterilizer
- f. **Close Sterilizer Door:** Grasp handle, and holding it in vertical position, pull door down until bottom of door rests in the bottom of door opening. Then rotate handle forward, engaging the lower curved portion under the horizontal rod in the casting at the bottom of the door opening. Push handle all the way down and back until door is locked securely in position.
- g. **SET EXHAUST SELECTOR:** Located at center of the control housing mounted on top of the unit, to correct position. Unit is now ready to start. All items, other than solutions, may be sterilized with selector at "Instruments". Solutions require a low exhaust. Place selector at "Liquids".
- h. **DETERMINE CORRECT STERILIZATION TIMES: 30 minutes**
(NOTE: In no case should the timer be set to less than 15 minutes. Sterilization will not be accomplished in less than 15 minutes exposure time.
- i. **TURN TIMER:** Located at upper right front of sterilizer. Select desired length of sterilizing period. This turns power supply on and

- j. starts the cycle after pressure temperature combination has been reached. Amber pilot light indicates that the timer is running.
- k. When the sterilizer chamber reaches the selected temperature, the timed exposure cycle will begin. When the exposure cycle is completed, the electric supply will be opened automatically. When the chamber pressure gauge located at the top of the control housing reads "0", the door may be opened. (Release handle and let go to avoid possible contact with remaining steam.) When opening the door, allow a few seconds for steam to escape from chamber before opening completely.
- l. To assist in drying racks, release door handle after pressure has been attained at start of cycle. Pressure in chamber will keep door closed. The use of a wire basket will provide better drying for dressings. At end of sterilizing cycle, release door handle and open slightly. Do not lift door to open position. This will allow steam and moisture to escape. Allow door to remain in this position for 15 to 20 minutes before removing load. Small packs can be dried successfully with this procedure. We do not recommend the sterilization of large packs, such as linens. Be sure condensate baffles are in position in the chamber.
- m. Remove load and check water level for next operation.
- n. Clean the unit after each use.

3. Use of Spore ampoule (BT Sure Biological Indicator to confirm sterilization)

a. Procedures

1. Place one BT Sure biological indicator in a horizontal position with representative materials to be sterilized inside the autoclave and another one outside the autoclave as a control.
2. Run the autoclave: Select the appropriate cycle and process the load.
3. At the end of the cycle: when autoclave finished completely, open the door and take the BT Sure biological indicator out of the autoclave and allow to cool for at least 10 minutes. Failure to cool at least 10 minutes may cause the glass ampoule to burst and may result in injury from hot liquid.
4. The chemical indicator on the label changes from blue to black when expose to steam. This distinguishes exposed

from unexposed units. NOTE: a black color doesn't indicate acceptable sterilization.

5. Any microbiological incubator that is adjusted for 55 to 60 °C will satisfy the incubation conditions for the BT Sure Biological Indicator.
6. To activate the media, place the indicator (sterilized and control one) in an upright position in a plastic crusher. Gently squeeze the crusher to break the glass ampoule. Place the activated indicators in the incubator rack, and incubate immediately for 24 hours @ 55 °C – 60 °C

b. Interpretation

1. Examine the indicator at regular intervals for any color change (24 hours). The appearance of a yellow color indicates bacterial growth. No color change indicates adequate sterilization.
2. Act on a positive test (a color change of yellow) as soon as the color is noted. Notify appropriate personnel.
3. The incubation time is 24 hours (meets the US FDA/RIT protocol).
4. Record the results.
5. Dispose of all used BT Sure biological indicators in accordance with your institution policy. Autoclave any positive cultures (121 °C) for no less than 30 minutes.
6. As a positive growth control, place an activated, unsterilized BT Sure biological indicator in the incubator at the same time you place the sterilized one.
7. Examine the positive indicator at regular intervals (24 hours). The yellow color is evidence of bacteria growth. Record the results. Removed all positive indicators as the yellow color is noticed, and disposed of as mentioned below.
8. If the positive control does not grow, do not use this unit from this package. Contact Thermo Fisher Scientific.

c. Storage and Disposal

1. Store BT Sure biological indicators at room temperature. Do not desiccate.
2. Do not store these indicators near sterilants or other chemicals
3. BT Sure biological indicators have a 24 month shelf life which is clearly designated on each box. Rotate your stock accordingly.
4. Do not use after expiration date printed on the package. Dispose of expired indicators by autoclaving @ 121 °C for no less than 30 minutes.

O. Quality Control

1. Media Preparation

For each new lot number three known culture media (Culti-Loops) must be tested. Media will be good for three month.

- a. Prepare the media according to **Media Preparation**.
- b. In a sterile, transparent, non fluorescent vessel labeled as a negative (-) for Pseudomonas Aeruginosa add 1.0 mL of culture media already prepared. Fill the vessel to the 100 mL mark with sterile deionized water. Add the content of a Colilert reagent and shake until dissolved.
- c. In a sterile, transparent, non fluorescent vessel labeled as a Positive/Negative (+/-) for Klebsiella Pneumoniae add 1.0 mL of culture media already prepared. Fill the vessel to the 100 mL mark with sterile deionized water. Add the content of a Colilert reagent and shake until dissolved.
- d. In a sterile, transparent, non fluorescent vessel labeled as a Positive (+) for Escherichia Coli add 1.0 mL of culture media already prepared. Fill the vessel to the 100 mL mark with sterile deionized water. Add the content of a Colilert reagent and shake until dissolved.
- e. Place vessels in incubator for 24 hours at 35 °C ± 0.5°C.
- f. After 24 hours read and record the results.
- g. Store the Culti-Loops in it original container at 2-8°C until used.
- h. Each Culti-Loop should contain an intact, dried, black film. Culti-Loop should not be used if: the color has changed; there is evidence of hydration; the expiration date has passed; or there are other signs of deterioration.

2. Sample

a. Distribution

1. Drinking water for compliance purposes: Preferably hold samples at <math><10^{\circ}\text{C}</math> during transit to the laboratory. Analyzed samples on day of receipt whenever possible and refrigerate overnight if arrival is too late for processing on same day.
2. Do not exceed 30 h holding time from collection to analysis for Coliform bacteria.

b. Surface Water Treatment Plant

1. Weekly QC: when samples are analyzed, run a negative control D. I. water/ *Pseudomonas Aeruginosa* (-), one Known positive (E Coli. or environmental sample-raw water).-**Once a week**
2. Bottle sterility check must be done every new lot.
3. Check bottles (10%) for fluorescence under the UV light every time you open a box or when you run bottle sterility check. Check bottles for any crack or broken seal.
4. Shake bottle at least 35 times to make sure the reagent is completely dissolved.
5. 10 % duplicates must be performed.
6. Any reference comparator provided by the manufacture should be discarded by the manufacturer's expiration date or once a year which ever is first.
7. Run Colilert P/A once a day on: Finished Water and Clearwell.
8. Make sure your hands are clean and or wearing glove when collecting the samples.
9. UV lamp must be replaced annually or checked with a UV light meter annually to verify that it emits > 70% of it initial output.
10. Make sure the area of analysis is clear, clean and disinfected.
11. Do not touch the inner part of the bottle nor the cap with your fingers or anything else that can contaminate the sample.
12. Run QC at least twice a year and PT yearly. Make sure all necessary information for the QC and PT sample is recorded. QC and PT samples should be treated as a regular sample. Information such as: Set up date, time and temp, reagent and bottles lot number, volume analyzed and incubator ID, sample ID, analyst, date, time and temp for results and results, should be included in the records.

13. Keep all colilert reagent, comparators, quanti-trays, bottles and media in the lab or in the storage room.
14. Sample volume: 100 mL.
15. Incubator temperature: 35 ± 0.5 °C.
16. Record Incubator temperature at least twice per day (AM / PM) with readings separated by at least 4 hours.
17. Volume check: measure 100 ml of DI water with a class A graduated cylinder and pour it in a sterile, transparent, non fluorescent borosilicate vessel manufacturer by IDEXX that has been preserved with sodium thiosulfate ($\text{Na}_2\text{S}_2\text{O}_3$). Mark the level. Use this in the field and in the lab for volume check purposes

3. Spore Ampoule (BT Sure biological indicator)

- a. Use biological indicator (BT Sure) to confirm sterilization in the autoclave once a month and record results on the autoclave sterilization log sheet. At a minimum, these records must include the incubation date, time and temperature, and color change.

4. Autoclave

- a. Use an autoclave thermometer with each cycle to confirm and verify sterilization temperature.
- b. Check autoclave thermometer against NIST thermometer annually
- c. Check autoclave sterilization time every 3 months.
- d. Autoclave door seals should be clean and free of caramelized media..
- e. Clean autoclave according to manufacturer instructions

5. Coliart & Colilert -18

- a. Coliart (24 hours)
 - Run colilert (18 or 24) quality control on every reagent lot.
 - In the event only one box of reagent (ex. Colilert-18) last longer than 4 month, quality control will be required again for the same lot #.
 - Record results on Coliart QC form

P. Revision History

Revision Date	Section Modified & modifications	Reason Changed	Revised By
10/22/2018	<ul style="list-style-type: none"> • Added rev date on 1st page • B: modified • M: updated • N.2.h updated • N.2.b.4 updated • P: section added • Q: updated 	Yearly update	Brenda Echandy

Revision Date	Section Modified & modifications	Reason Changed	Revised By
11/28/2018	Section: <ul style="list-style-type: none"> • K.2 modified and added note for sample volume • L.4 added: Invalidate sample • O.2.b.9 Added: Lamp detail • O.2.b.12 Modified- QC and PT necessary information required for traceability • O.2.b.17 Added : Volume check 	Laboratory on site Evaluation findings and recommendations (performed 11-8-18)	Brenda Echandy
12/08/2020	<ul style="list-style-type: none"> • N/A 	Yearly Review	Brenda Echandy
12/29/2021	<ul style="list-style-type: none"> • N/A 	Yearly Review	Ben Tedder

Q. Reference:

Standard Methods for the Examination of Water and Wastewater, 22th Edition
2012. Section 9223 B Enzyme Substrate Test, Pages: 9-93 – 9.95

Standard Methods for the Examination of Water and Wastewater, 22th Edition 2012
Pp 9-21 Section 9060 B Preservation and Storage

Remel Culti-Loops instruction sheet

BT Sure Biological Indicator, Thermo Fisher Scientific. Rev. 15; 1/16/08;
Part No. 7011

**Manual for the Certification of laboratories Analyzing Drinking Water- Criteria
and procedures Quality Assurance**, 5th Edition. Chapter V: Critical Elements for
Microbiology

The Update: **Office of Environmental Laboratory Certification, DHEC**. March 2010.

Coliler-18 IDEXX 2011. Information sheet: 06-02027-18

Market Forge Sterilmatic Manual

Rev. 12/29/2021 (SWTP/BT)