CHARLES TOWN UTILITY BOARD
AGENDA

WEDNESDAY, JANUARY 27, 2021

Regular Meeting | **661 South George Street, Charles Town, WV 25414** | **4:00 PM**

CALL TO ORDER

1. **APPROVAL OF MINUTES**
   a. Approval of January 13, 2021 Regular Meeting Minutes
   UB Minutes January 13, 2021.pdf

2. **PUBLIC COMMENT**
   This portion of the agenda is designed for members of the general public to share thoughts on items of interest in the community. By law, Board members may ask clarifying questions or discuss procedural matters but are not permitted to discuss the policy merits of any issue unless it is scheduled for discussion.

   Until such time as Governor Justice revokes Executive Order 09-20 or any subsequent executive order that is primarily intended to address the public health emergency and spread of COVID-19 by restricting public gatherings and invoking physical distancing, public access to the meeting room will be restricted. Members of the public may still submit written comments to kstolipher@ctubwv.com that will be read aloud. Up to 20 minutes of time will be allotted for reading public comments.

   The public is invited to attend this meeting via webcast (www.ctubwv.com - Board Meetings - Meeting Agendas and Minutes 2021). The public may also attend the meeting by accessing the following zoom link:
   https://zoom.us/j/97449430378?pwd=emVPZm1VjhRNDh4bU1LVnZSR3A3QT09
   or by calling 1-301-715-8592 and entering the Meeting ID 974 4943 0378 and Passcode 118273.

3. **SWEARING IN: THOMAS STOCKS - TERM ENDING DECEMBER 31, 2024**

4. **PROJECT UPDATES**
   a. Route 9 Sewer Project - Change Order No. 8
   Change Order No 8.pdf
   b. GDF - Presentation on Disinfection Byproducts
   DBE Assessment Jan2021.pdf
   c. RK&K - Presentation on Draft Sewer Model
   DRAFT Sewer Model 1-27-21.pdf

d. RK&K - Presentation on Manhole Evaluation Task Order 14
Manhole Evaluation Report.pdf
e. RK&K Task Order 14 Scope of Work Change - Manhole Evaluation
Task Order 14 SOW Change Manholes.pdf
f. Legal Services Contract for Rate Equalization and Related Matters
g. Class Cost of Service Proposal
Gannett Fleming Proposal.pdf

5. **MANAGEMENT REPORTS**
   a. Utility Manager Report
   i. Schedule of Capacity Improvement Fee Analysis
   CIF Analysis Schedule.pdf
   b. Chairman Report

6. **APPROVAL OF BILLS**

7. **ADJOURNMENT**

8. **INFORMATION ONLY - NEXT MEETING - FEBRUARY 10, 2021 AT 4:00 PM**

January 13, 2021

The Charles Town Utility Board held a virtual meeting on January 13, 2021 at 4:00 p.m. Members of the Board present were Daryl Hennessy, Pete Kubic, Duke Pierson, Jacquelyn Milliron and Tommy Stocks. Also present were Hoy Shingleton, Kristen Stolipher and April Shultz. The Chairman called for changes or corrections to the December 21, 2020 special meeting minutes. Jacquelyn had one change. The Board approved the minutes as amended. There were no public comments.

First discussed was RK&K – Task Order No. 14 Manhole Evaluation Report. Kristen provided that RK&K performed an evaluation on 65 manholes in troubled areas throughout the system to address structural issues and evaluate if there were issues with I&I. They did find that a number of structures are in need of repairs due to deterioration. Ideally, staff would like to address the critical ones in-house and possibly include others with the 2021 Collection System Project. RK&K will be present at the next meeting to review and discuss any questions or concerns with the report.

Next discussed was RK&K – Task Order No. 16 Lloyd's Flat and Moose Lodge. Kristen explained the task order was part of an evaluation in the northern region of the prior PSD system as it related to diversion of flows and decommissioning of stations as a result of the Route 9 project. Since the Route 9 project is done, staff is now ready to proceed with the decommissioning of the Lloyd's Flat pump station. As a result of that, all flows will be diverted into the Route 9 line which will reduce flows at the Moose pump station, reducing that station to a grinder pump only serving the Moose, and other properties in that area. This task order is to design those improvements. Jacquelyn asked for a cost benefit analysis for decommissioning the pump station. Kristen provided that it costs an average $42,000 per year to maintain the two stations so a substantial cost savings would occur. Motion from Duke and second by Tommy, the Board approved Task Order No. 16.

The Chairman next opened the floor for discussion on the Route 9 Sewer Project Resolution No. 11 – Contractor Pay Application 011, Hatch Invoices, and CTUB Reimbursement. Kristen noted final payment is anticipated at the next meeting as staff is working through final items to address clean up issues in the Spring. Jacquelyn had several questions regarding the financials of the project. Motion by Pete, second by Jacquelyn, the Board approved the Route 9 Sewer Project resolution No. 11.

Next was a discussion on the draft Rate Equalization Schedule and Project Update. John Stump and Hoy Shingleton joined the discussion. The Chairman noted that this item will be going back to City Council on Tuesday, January 19th and would like to come to a consensus to take back to the Council at that meeting. Kristen and April provided options for rate equalization and the financial implications for numerous rate equalization scenarios. Kristen also mentioned that staff would like to proceed with a cost-of-service study to determine the most appropriate rate structure for the utility. Staff recommended Option 2b, to take the District single tier to the multiple tier structure and raise the CT rates 5% to equalize with the Ranson rates and decrease the District rates by 7.5%. Staff believed this would provide a consolidated rate structure amongst all the classes and allows to have adequate residual surplus to run the system by achieving the goal of a unified rate structure. The Board made several comments on the various rate options. The Board was invited to attend the City Council workshop for the rate discussion.

Next, the Chairman opened the floor for discussion on the Utility Manager Report. Kristen briefed the Board on this month's efforts and upcoming task orders including property auctions, a draft strategic plan, safety training, board member/staff training, various sewer and water project updates and plant flows and CIF updates. She mentioned that rebudgets for the current fiscal year will be on the agenda next month. Kristen also briefed the Board on the Legal Services RFQ Response. Only one response was received, from Tim Stranko, PLLC. The Chairman noted this RFQ was for rate

equalization only and that Hoy would continue to represent the Board as legal counsel. Jacquelyn had a concern with public interest and simultaneous representation since Mr. Stranko represents the City of Ranson. Kristen read a written statement regarding conflict of interest provided by Mr. Stanko. Jacquelyn preferred to have an opinion from the WV Rules Conduct and the Chairman requested Kristen reach out to Mr. Stranko to provide for the next meeting.

Under the Chairman Report, the Board discussed the Consultant Service Agreement. He briefed the Board that the Consultant Agreement with Jane Arnett has expired and would not be extended. Staff occasionally reaches out to her for questions and Jane has provided help at no charge, but staff would come back to the Board if staff would need her assistance on a larger project. The Chairman also mentioned that staff would not be renewing the contract with Mike Venters.

Also discussed was the 2021 Board of Director's Meeting Schedule as presented as well as a time change for those meetings. The meetings used to be held at 8:30 AM and the Chairman asked if the consensus of the Board would be to turn to that time. Tommy, Duke, and Pete all agreed with a morning meeting. Jacquelyn was concerned with the time and the ability for the public to attend at that time. The Chairman would take this to the City Council for their opinion.

Next, the Approval of Bills was discussed. The Board approved the payment of bills with no objections, after discussion from Jacquelyn.

The meeting was adjourned at 6:06 p.m. The January 27th regular meeting will be held virtually at 4:00 p.m.

_____ _____

Chairman Secretary

CHANGE ORDER

Change Order No. 8

Date of Issuance:	**January 22, 2021**	Effective Date:	**January 27, 2021**
Owner:	**Charles Town Utility Board**	Owner's Contract No.:	
Contractor:	**Snyder Environmental Services, Inc.**	Contractor's Project No.:	
Engineer:	**Hatch Associates Consultants, Inc.**	Engineer's Project No.:	**H-359787**
Project:	**Route 9 Sewer Project**	Contract Name:	**Route 9 Sewer Project**

The Contract is modified as follows upon execution of this Change Order: **Contract Time extension of 17 days to complete the 30-day Acceptance Test. The Ready for Final Payment date changes from February 7, 2021 to February 24, 2021.**

CHANGE IN CONTRACT PRICE	**CHANGE IN CONTRACT TIMES** *[note changes in Milestones if applicable]*
Original Contract Price:	Original Contract Times:
	Substantial Completion: **210 days**
$ 8,453,848.00	Ready for Final Payment: **270 days**
~~[Increase]~~ [Decrease] from previously approved Change Orders No. 1 to No. 7:	[Increase] [Decrease] from previously approved Change Orders No. 1 to No. 7:
	Substantial Completion: **35 days**
$ <1,475,790.98>	Ready for Final Payment: **0 days**
Contract Price prior to this Change Order:	Contract Times prior to this Change Order:
	Substantial Completion: **245 days**
$ 6,978,057.02	Ready for Final Payment: **305 days**
~~[Increase] [Decrease]~~ of this Change Order:	[Increase] ~~[Decrease]~~ of this Change Order:
	Substantial Completion: **17 days**
$ 0.00	Ready for Final Payment: **0 days**
Contract Price incorporating this Change Order:	Contract Times with all approved Change Orders:
	Substantial Completion: **264 days (November 30, 2020)**
$ 6,978,057.02	Ready for Final Payment: **341 days (February 24, 2021)**

RECOMMENDED:	ACCEPTED:	ACCEPTED:
By:	By:	By:
Engineer (if required)	Owner (Authorized Signature)	Contractor (Authorized Signature)
Title: Sr. Project Manager	Title:	Title:
Date: 1/22/2021	Date:	Date:

DISINFECTION BYPRODUCT EVALUATION AND ASSESSMENT

FOR THE

CHARLES TOWN UTILITY BOARD
WATER TREATMENT PLANT AND DISTRIBUTION SYSTEM
661 SOUTH GEORGE STREET
CHARLES TOWN, WV 25414

PREPARED BY

GWIN, DOBSON & FOREMAN, INC.
3121 FAIRWAY DRIVE
ALTOONA, PA 16602

JANUARY 2021

DRAFT

CHARLES TOWN UTILITY BOARD WATER SYSTEM
DISINFECTION BYPRODUCT EVALUATION AND ASSESSMENT

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APPENDICES

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GD&F
GWIN
DOBSON &
FOREMAN
ENGINEERS

January 22, 2021

Charles Town Utility Board
661 South George Street, Suite 101
Charles Town, WV 25414

Attn: Kristen M. Stolipher, Utility General Manager

RE: Charles Town Utility Board
Water Treatment Plant and Distribution System
Disinfection Byproduct Evaluation

Dear Mrs. Stolipher:

Per your request, Gwin, Dobson & Foreman, Inc. has provided an electronic draft copy of the Water Treatment Plant and Distribution System Disinfection Byproduct Evaluation dated January 2021.

Respectfully submitted,
GWIN, DOBSON & FOREMAN, INC.

Christopher M. Eckenrode

Christopher M. Eckenrode, P.E.
Senior Project Engineer

CME/amk
20058/Ltr/CTUB_WTPDBPEval_1-22-21.doc
cc: File

1.0 INTRODUCTION

The following Water System Disinfection Byproduct Evaluation and Assessment was prepared for Charles Town Utility Board (CTUB), per their request as the CTUB's WTP is experiencing current disinfection byproduct issues and has experienced historical elevated DBP levels in their distribution system.

The purpose of this study is to evaluate existing water quality, identify the Disinfection Byproduct concerns, evaluate the viable treatment alternatives, and make recommendations for the optimum strategy for the Charles Town Utility Board Water Treatment and Distribution System.

This report includes a description of the existing treatment system and a summary of existing water quality data. The study then provides an evaluation of viable disinfection byproduct treatment alternatives using several resources, an engineering evaluation and literature review. Several testimonies from facilities that have implemented the recommended disinfection byproduct treatment have also been considered. Following the evaluation of alternatives, the recommendations of the study will be presented along with what is required from a regulatory standpoint.

2.0 SYSTEM SUMMARY

The Charles Town Utility Board Water System consists of one (1) Water Treatment Plant (WTP). The WTP receives its source water from the Shenandoah River. The Water Treatment Plant is located along Charles Town Road and was originally constructed in 1989. This Plant is a conventional sand filtration water treatment plant rated for 3.0 MGD and consists of two (2) rapid mix basins, four (4) clarifiers, four (4) dual media filters, two (2) sedimentation basins, one (1) clearwell, Disinfection (Chlorination and Ammonia) and Fluoridation.

The system serves a population of approximately 14,901 via 5,560 residential and 615 commercial connections throughout a 15 square mile area. The distribution system consists of approximately 71 miles of distribution piping ranging from 16" to 3/4" in diameter, eight (8) gravity storage tanks and two (2) booster pumping stations. The WTP concurrently produces an average of about 1.7 million gallons of water per day while operating for 17 hours per day.

As taken from the West Virginia Department of Health and Human Resources CTUB Sanitary Survey, to control the level of Disinfection Byproducts (DBPs) in the distribution system, a 40% solution of liquid ammonium sulfate is fed into the plant's effluent to convert the free chlorine to mono chloramine. HACH CL17 online chlorine analyzers continuously monitor the plant free chlorine residual in the clearwell and the total chlorine residuals following the addition of the ammonium sulfate. The ammonium feed rate is paced by an automatic flow controller to maintain a free chlorine residual 0.0-0.1 mg/L leaving the plant. The operational goals are to have free chlorine of 3.0 mg/L in the clearwell and 0.0 mg/L free chlorine residual leaving the plant, while maintaining excess ammonia leaving the plant and throughout the distribution system between 0.2 mg/L and 0.3mg/L, total chlorine residual equal to the monochloramine residual, as well as in the distribution system.

Charles Town briefly experimented with eliminating the ammonium sulfate feed after the WTP upgrades were completed. This resulted in distribution system disinfection byproduct results in excess of the current TTHM (80 ug/L) and HAA5 (60 ug/L) Maximum Contaminant Level (MCL) limits which are set by the U.S. Environmental Protection Agency (EPA) Stage 2 DBP Rule.

CTUB appears to be complying with the Total Organic Carbon (TOC) Treatment Technique (TT) removal requirement by maintaining the running annual average of finished water TOC less than 2.0 mg/L. However, summer and fall finished water TOC results are routinely above 2.0 mg/L which leads to greater disinfection byproduct formation.

It is to be noted CTUB failed to meet Required % TOC Removal in January and August 2019 as shown in the Quarterly Operational Report in Appendix A.

3.0 SUMMARY AND DISCUSSION OF EXISTING WATER QUALITY DATA

3.1 TOC Data

As natural occurring total organic carbon (TOC) within the surface water source comes in contact with chlorine, several disinfection byproducts are formed. The current regulated and most well-known DBPs are referred to as total trihalomethanes (TTHMs) and total haloacetic acids (HAA5s).

A plant-wide TOC sampling analysis was conducted on November 11 and November 16, 2020 (Refer to Table 1 below). Specifically, on November 16, 2020, the results indicated a raw water TOC content of 4.3 mg/L, with 4.0 mg/L being Dissolved Organic Carbon (DOC) or 93%. This implies that the majority of the TOC would pass through a filter since it is in the dissolved state. The settled water TOC (post sedimentation basins and plate settlers) was 3.0 mg/L, while the filtered water TOC was 2.7 mg/L. As noted in Section 2, this is above the Treatment Technique goal of 2.0 mg/L. A sample of the sludge from the thickener tank revealed a TOC of 27.7 mg/L, where it is highly concentrated.

Table 1:
November 2020 Plant Wide TOC Sampling Event

Sampling Location	Analysis	Date	
		11-Nov-20	16-Nov-20
Settled Water (Filter Influent)	Dissolved Organic Carbon	0.014 mg/L	-
Settled Water (Filtered Influent)	Total Organic Carbon	1.5 mg/L	3.0 mg/L
Raw Water	Total Organic Carbon	1.8 mg/L	4.3 mg/L
Raw Water	Dissolved Organic Carbon	-	4.0 mg/L
Thickener Tank	Total Organic Carbon	2.1 mg/L	27.7 mg/L
Filtered Water	Total Organic Carbon	2.4 mg/L	2.7 mg/L

GD&F's experience indicates that when the raw water TOC value exceeds 4.0 mg/L, it is very difficult for a conventional treatment plant to reduce the TOC below the targeted value of 2.0 mg/L. TOC exceedances generally occur during the warm summer/fall months as algae blooms and other organics present in the raw surface water source are at their highest concentration.

The existing sedimentation basin which contains plate settlers, is currently the most effective treatment technique utilized by the plant to reduce TOC. First a coagulant is added and mixed, then large floc particles are formed which settle out in the bottom of the sedimentation basins. On November 16, 2020, day of TOC sampling, the basins were removing 30% of the TOC in the raw water, which is typical of most surface water source treatment plants. As seen from the sampling data in Table 1, very little of the TOC (7%) was being removed by the filters, which is again typical.

A representative TOC sample of the thickener sludge was taken since the plant features internal process wastewater recycle. This means that all the backwash water from the sand filters and also any overflow water from the 13,000 gallon gravity thickener tank is recycled back to the head of the plant. Since the conventional sand filters are obviously removing some TOC, this TOC is being recycled back through the plant.

Also, the existing 13,000 gallon gravity thickener tank is severely undersized. The solids from the sedimentation basins are generally removed at least once per day to prevent excess accumulation of solids in the basins. The thickener tank is used to store the settled solids from the sedimentation basin which have a very high TOC content (27.7 mg/L) as indicated by the sampling results. The operator noted that the thickener tank overflows daily due to the tanks small holding volume. As a result, the highly concentrated TOC solids are being conveyed back to the head of the plant where they are recycled. This recycling process is compounding the already elevated TOC issue in the raw water.

There is currently no WVDEP NPDES discharge permit associated with the water treatment facility, thus there is nowhere for the process wastewater to be discharged. The settled solids from the thickener are transported to CTUB's wastewater treatment facility digester for further processing.

Table 2 below summarizes the plant TOC data by monthly average. The Quarterly Operational Reports are included in Appendix A.

Table 2 :
Raw and Finished Average Monthly TOC Data, January 2019 to December 2020

Month	2019		2020	
	Raw	Finished	Raw	Finished
January	1.5	1.2	2.6	1.9
February	1	0.8	2.7	2
March	1.5	1.1	2.5	1.4
April	1.5	1	3	1.8
May	3.8	2.6	2.5	1.8
June	2.1	1.5	2.7	1.4
July	2.8	1.8	3.8	2.6
August	2.4	2.2	4.9	3.6
September	2.7	1.8	3.8	2.2
October	3	2.1	3.4	2.2
November	3.7	2.7	3.5	2.2
December	2	1.4	5.3	2.3
Average	**2.3**	**1.7**	**3.4**	**2.1**

Table 2 indicates that raw water TOC monthly average values are routinely above 3.0 mg/L, while finish water TOC results are routinely above 2.0 mg/L. The recent increase in raw water TOC is likely due to the abnormally high temperatures and dry weather conditions.

3.2 TTHM and HAA5 Sampling Results

Disinfection byproducts such as TTHMs and HAA5s are formed when chlorine is introduced to water with TOC. The chlorine reacts with the TOC to form various disinfection byproducts.

The operators conducted TTHM and HAA5 sampling in the existing plant clearwell tank, as well as in the distribution system. Results indicated that the majority of the disinfection byproducts are being formed within the clearwell itself as opposed to out in the distribution system. Typically, a large percent of the TTHMs and HAA5s are formed within the distribution system due to water age and elevated water temperatures or lack of turnover in water storage tanks. However, this does not appear to be the issue with Charles Town.

The high TTHM and HAA5 values in the clearwell are directly related to the elevated TOC levels entering the clearwell. Ammonia addition is helping to reduce TTHMs and HAA5s in the distribution system. However, the ammonia addition is after chlorination and chlorine contact time, thus by the time the ammonia is added, the DBPs have already been formed.

TTHM and HAA5 sampling was conducted by water treatment plant personnel in October and November 2020 and used to create Figures 1 and 3 below. The annual Consumer Confidence Reports (CCR) were used to create Figures 2 and 4 below. In addition to lowest and highest detections, the CCR calculates the running annual average (RAA). The RAA is calculated quarterly via monthly averages for the last 12 months during the year covered in each CCR. These figures show several TTHM and HAA5 sampling results above the MCL. The full TTHM and HAA5 sampling results and Consumer Confidence Reports are included in Appendix B for reference.

From the data, we can conclude that the TTHMs and HAA5s are not forming in the distribution system in significant amounts and the high levels observed in sampling are in the clearwell prior to entering the distribution system. TTHM concentrations are highest in water that has resided in the distribution system the longest. More organic matter in the source water can result in a higher chlorine demand to maintain a reliable residual throughout the distribution system. Spatially, Tuscawilla Hills is furthest from the WTP and contains lower concentrations of DBPs than the closest sampling point to the WTP at NW Main Street.

The pH in a distribution system also affects DBP concentrations. In general, TTHM formation increases with increasing pH. HAA5 formation and decomposition seems to follow a pattern that is different than that of TTHM in the distribution system. Research suggests that HAA5s seem to form and then decompose in systems with biological activity. As a result, maximum residence times (MRTs) do not necessarily have the highest concentrations of HAA5.

Figure 1:
Distribution System Sampling - TTHMs

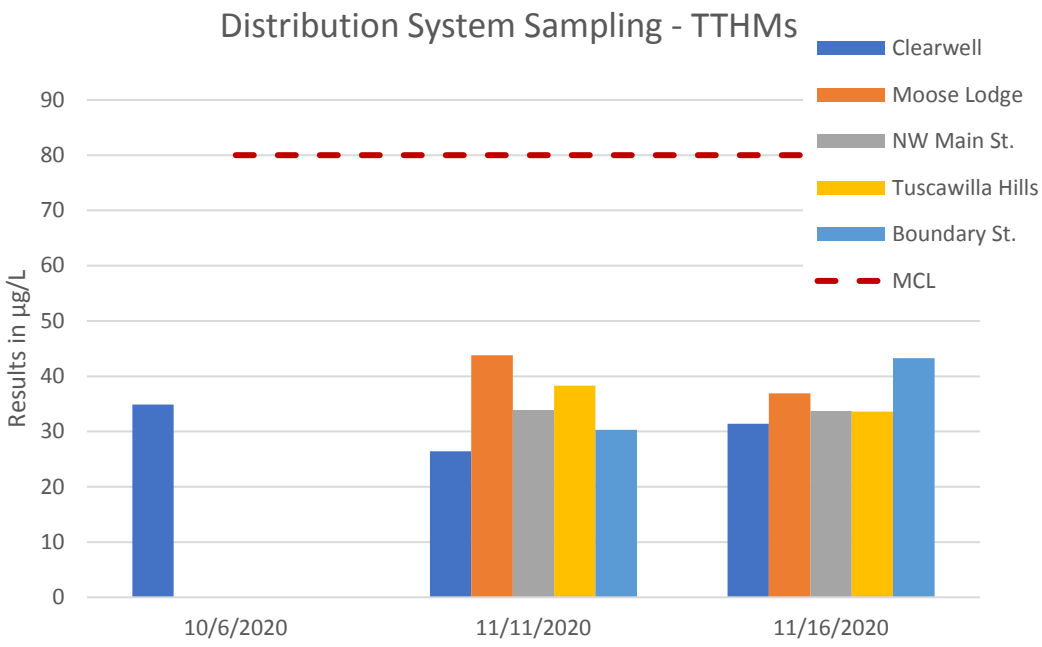


Figure 2:
CCR Results - TTHMs

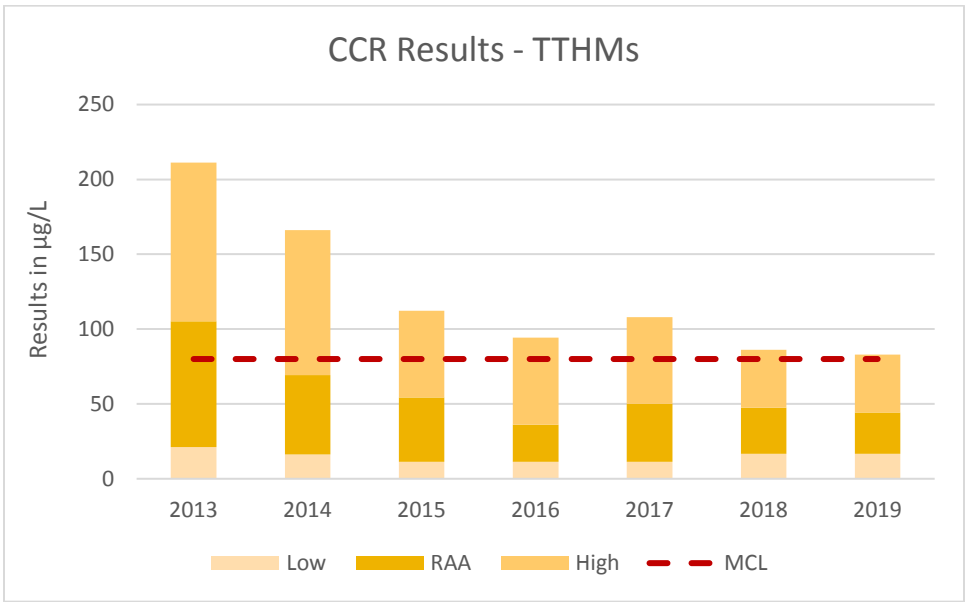


Figure 3:
Distribution System Sampling - HAA5s

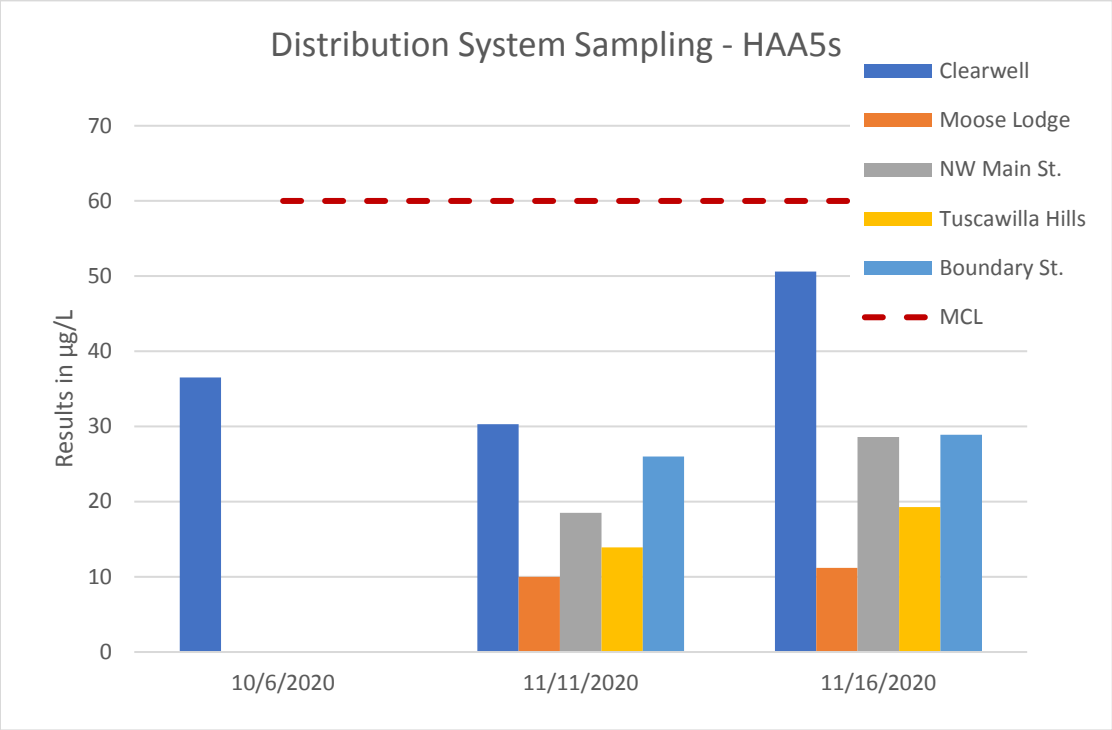
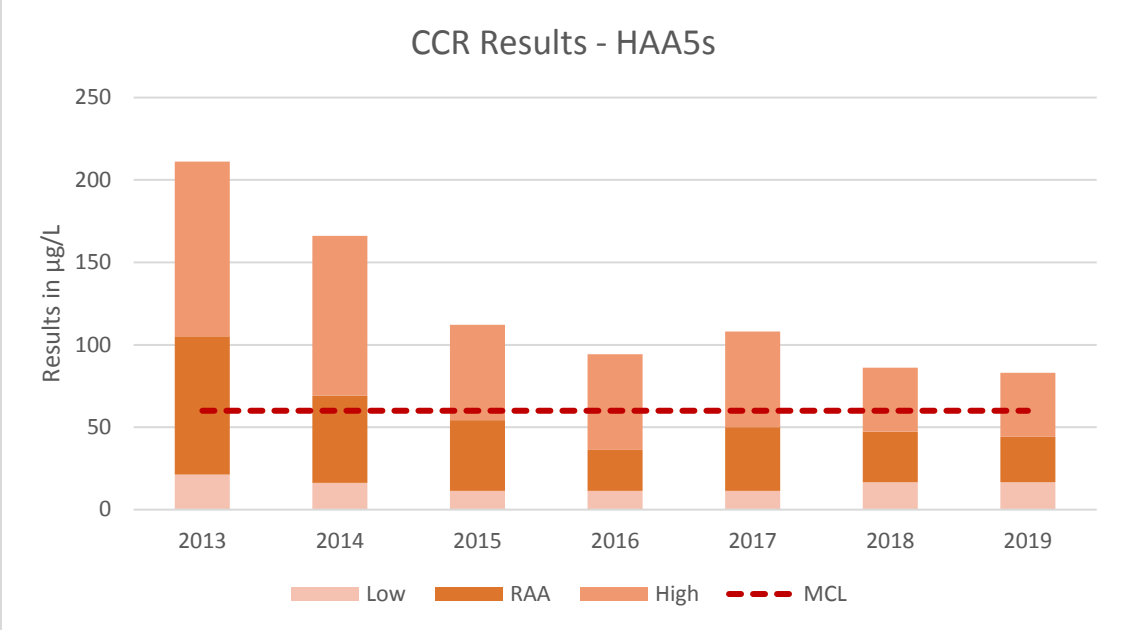


Figure 4:
CCR Results - HAA5s



4.0 ALTERNATIVES ANALYSIS

Seven (7) alternatives have been evaluated and are outlined below aimed to reduce DBP levels in the Charles Town Water System.

1. Adding Groundwater Wells as Backup Supply

2. Stop Recycling the Wastewater

3. Granular Activated Carbon

4. UV Disinfection and adding Hydrogen Peroxide

5. Ozone Treatment

6. Powdered Activated Carbon

7. Reverse Osmosis

Alternative No. 1 - Adding Groundwater Wells as Backup Supply:

This alternative involves adding groundwater wells as a supplemental source to the raw water. Groundwater wells typically have consistent TOC values below 0.50 mg/L. Thus, by blending a portion of the river water with groundwater, the total raw water TOC will be reduced proportionally to the flow rates. This TOC reduction would have a direct effect on lowering DBPs. Groundwater wells also generally have much lower and stable turbidity than surface water and results in less accumulated sludge production. Due to the constant water temperature (+/- 54 degrees Fahrenheit), groundwater wells can also provide warmer water in the winter to prevent freezing issues at the exposed sedimentation basin. Groundwater wells can also cool the surface water in the summer which aids in maintaining lower chlorine residuals in the clearwell, which results in DBP reduction.

In addition to DBP reduction, the wells would also provide a supplemental source of raw water. If a contamination event were to occur in the Shenandoah River or an intake system failure were to take place, a secondary source would allow the CTUB to maintain water production without the use of the river source.

Some drawbacks to groundwater wells are higher concentrations of dissolved metals such as iron and manganese. In this case, the metals would require additional permanganate chemical feed for oxidation. Also, wells can be limited in capacity depending on the hydrogeology. Some well fields are located miles from the treatment plant and thus require new underground piping to convey the raw water to the plant. If the wells are in remote locations, extending power to the wells can be costly. Wells also require wellhead protection areas surrounding the wells to prevent water contamination.

The concerns above can be better defined by conducting a Phase I Hydrogeological Survey and a pump test prior to well production. A professional hydrogeologist could perform a Phase I Survey of the area to determine if the development of wells is feasible. The total estimated cost to perform a Phase I Survey is $10,000. Depending on the depth, size, yield and distance from the treatment plant, well construction typically costs between $100,000 to $250,000 per well. This includes, design, permitting, drilling, testing, well construction, power, pump, pitless adapter and well drop piping costs. Additional costs would be the extension of well lines to the plant and purchasing of land or required easements.

Implementing this alternative would certainly reduce the DBPs; however, this alternative alone will not entirely alleviate the DBP exceedances.

Alternative No. 2 - Stop Recycling the Process Wastewater:

Current operations are such that all filter backwash water and thickened sludge overflow is sent back to the head of the plant. As shown in the sludge sampling results, the TOC being returned to the head of the plant can be more than six (6) times that of the raw water TOC. Eliminating the recycle would ensure that excessively turbid water with high TOC levels are not being returned to the head of the plant where ultimately elevated DBPs are forming. This can be accomplished via obtaining a National Pollutant Discharge Elimination System (NPDES) permit and constructing lagoons or sand drying beds at the plant site. This would allow the decant water from a lagoon or sand drying bed to be conveyed directly to an NPDES discharge location as opposed to being recycled.

A potential issue in receiving an NPDES permit from the WVDEP is the water treatment plant's proximity to a water source. The Shenandoah river is approximately 1.1 miles from the plant, while the Evitt's Run tributary is about 750 feet closer than the Shenandoah. However, extended discharge effluent lines are not uncommon and often worthwhile. Other disadvantages of an NPDES permit are additional sampling costs and meeting effluent limitation guidelines.

GD&F made a preliminary analysis to install a NPDES Discharge line along Charles Town Road. There is consistent gravity fall from the WTP to Evitts Run. The new line would require a few road crossings; however, per initial U.S. Fish and Wildlife research, no critical habitats for endangered species were noted.

Obtaining an NPDES permit is being listed as a potential option; however, an entire study would need to be performed to determine if this is a viable solution. Items such as environmental impacts of the pipeline, location, easements and constructability should be assessed. For budgetary purposes, it is estimated that construction of a gravity NPDES line from the plant to Evitt's Run would cost about $600,000.

If lagoons or drying beds were constructed, all sedimentation basin and filter backwash waste would be pumped to the lagoons or drying beds were the solids would be settled or filtered. It appears that the existing pumps could be used to convey the waste to the lagoons or drying beds. By adding polymer to the wastewater, settling of the solids should not be an issue. The lagoons or drying beds would likely need to be cleaned at least once or twice per year. The decant from the lagoons or drying beds would be sent to the NPDES discharge. The "dried" solids would then be conveyed to a landfill (not the wastewater treatment facility).

Implementing this alternative would immediately reduce disinfection byproducts; however, this alternative alone will not alleviate the DBP exceedances. A combination of Alternative No. 1 and No. 2 would likely stop the DBP exceedances.

Alternative No. 3 - Granular Activated Carbon:

Another option is to further treat the water via the implementation of granular activated carbon (GAC) filtration following conventional filtration. The GAC system can remove 25-75% of the TOC and organic contaminants such as various endocrine disrupters, pharmaceuticals and personal care products (PPCPs) down to a non-detectable level. GAC works through adsorption generally via coconut or bituminous coal-based media. Average hydraulic loading rates are 6-10 gpm/ft^2 with an average empty bed contact time of 7-10 minutes. A 12-foot diameter, 30,000 pound

vessel can filter at a maximum flow rate of 1,100 GPM. They operate as fixed beds in series or in lead/lag type configurations. The GAC feed water flows through the activated carbon under low pressure, while the carbon adsorbs the organic contaminants. There are no electrical requirements for a GAC system with the exception of needing low pressure feed.

When the activated carbon becomes saturated (exhausted) the system it is taken off-line for replacement of the spent carbon. This can be every few months or years depending on the TOC loading and break-through rates. The GAC vessels can also be retrofitted to accommodate specific resins which will remove emerging contaminants such as Polyfluoroalkyl Substances (PFAS), 1-4, dioxane and hexavalent chromium.

At a 3 MGD maximum design plant flow, this would consist of six (6) total 30,000 pound vessels. The estimated GAC equipment cost including installation is $1.4 million.

It costs about $75,000 per carbon bed exchange of a 30,000 pound vessel. Estimated organic break-through can be calculated via a pilot study. A minimum of 2 carbon bed exchanges should be anticipated per year for O&M purposes, which corresponds to $150,000 per year in GAC media replacement.

A new filter building and booster pumps are necessary if the GAC filtration option is chosen. A 4,000 SF heated and ventilated space would also be required. The total estimated construction cost of a new building featuring booster pumps, underground and interior mechanical piping, valves, instrumentation and GAC equipment is $2.4-$2.75 million, not including soft costs.

The effectiveness of TOC removal is best tested via a pilot study. The total estimated cost of a 3-month GAC system pilot rental and testing is $25,000.

The implementation of this alternative alone would likely alleviate the DBP exceedances. It would also place the plant in better position to be in compliance with future regulations of organic contaminants which are currently being monitored via EPA's Unregulated Contaminant Monitoring Rules (UCMR's).

Alternative No. 5 - UV Disinfection and Adding Hydrogen Peroxide

Ultraviolet (UV) disinfection is an alternative that could be used as an additional treatment barrier. Ultraviolet disinfection of water consists of a purely physical, chemical-free process. UV disinfection uses a UV light source, which is enclosed in a transparent protective quartz sleeve. It is mounted so that water can pass through a flow chamber, and UV rays are emitted and absorbed into the stream. When ultraviolet energy is absorbed by the reproductive mechanisms of bacteria and viruses, the genetic material (DNA/RNA) is rearranged so they can no longer reproduce. They are therefore considered "dead" and the risk of disease has been eliminated. UV disinfects water without adding chemicals and does not create new chemical complexes. Also, UV does not change the taste or odor of the water, nor remove beneficial minerals.

The UV process is cost effective, does not use chemicals and may reduce post-filtration chlorine demand. Reduced chlorine usage reduces the formation of disinfection by-products and could further aid in the CTUB's compliance with the Stage 2 Disinfection Byproducts Rule (DBR2).

The chemical addition of hydrogen peroxide could be added prior to UV disinfection as an advanced oxidation process (AOP). Combining ultraviolet light with hydrogen peroxide generates highly reactive hydroxyl radicals without the addition of metal catalysts resulting in destruction of refractory organics (such as 1,4-Dioxane) without generating sludge or residue. This would assist in removal of organic and inorganic micropollutants that may pass through the filters.

A small building addition would be required to house the UV units. The total estimated cost to install a building addition, two (2) redundant UV units, contact piping and a hydrogen peroxide chemical feed system and electrical is $1.7 million.

The use of AOP's is state-of-the-art technology. A full pilot study would need to be conducted prior to implementation. A cost estimate for this pilot study, including testing is $50,000.

This option would help lower DBP levels, however, the actual results are unknown without conducting a pilot study.

Alternative No. 6 - Ozone

Ozone gas, known to be a very powerful oxidizing agent, is often used for reduction of TOC. This can be via ozone generators or via liquid oxygen converted into ozone. The ozone is injected into the raw water flow at a rate designed to help break-down the high TOC compounds, oxygenate the water, and reduce color issues while limiting bromate formation. Ozone has proven effective in improving water treatment plant performance, increasing customer satisfaction, and meeting increasingly stringent regulatory requirements. The benefits include disinfection; reducing chlorine disinfection by-products; micro-coagulation; enhanced filter performance; biological filtration; oxidation of iron, manganese, sulfide, reducing taste and odor-causing compounds, pharmaceuticals and personal care products, and endocrine disrupting compounds.

Despite the effectiveness of ozone in water treatment, ozone remains an expensive option compared to other successful alternatives. Also, this alternative can be dangerous and presents safety concerns to personnel. Sufficient space is required either for ozone generators and air compressors or outdoor liquid oxygen tanks, booster pumps, injectors, stainless steel piping, concealed ozone contactor tanks, ozone gas destructors, ozone monitors and detectors. Sufficient ozone contact time must be present through the ozone contactors.

The total estimated cost for a new 3 MGD ozone generating system, building, piping, equipment, contact tanks, instrumentation, etc. is $3.5-4 million. There would also be significant O&M costs involved either through purchasing of liquid oxygen or maintaining the ozone generators and compressed air system.

While the implementation of this alternative would eliminate DBP issues, it is by far the most expensive to implement.

Alternative No. 7 - Powdered Activated Carbon

Powdered Activated Carbon (PAC) is typically injected into the raw waterline to aid in the settling of organics in the sedimentation basin. The PAC comes in 1,000 pound supersacks and is displaced through a screw-feeder into an eductor. The eductor utilizes water pressure and pulls a vacuum such that the powder is mixed with water and injected into the raw waterline. The PAC is generally made of bituminous coal-based material that has a very high surface area which allows particles to conglomerate and settle.

PAC is widely used at treatment plants utilizing surface water sources throughout the United States. It is effective at aiding in the TOC removal in the sedimentation basin. GD&F's experience has shown that when PAC is used, a raw water TOC reduction of 5-20% can be achieved depending on the amount and type of carbon being fed.

The equipment consists of a bulk carbon feeder with a hoist and trolley to load/unload the supersack. It requires a potable waterline feed and discharge pipe to the raw waterline. The installed equipment cost is around $100,000; however, a separate 250 SF space that it at least 16 feet high is required. The feeder control panel and trolley/hoist require a separate power supply. This would require the purchasing of bulk bags of PAC and it should be noted that the PAC does add to the accumulation of settled solids. PAC is also very dusty and messy to work with. The total estimated construction costs to install a PAC feed system inside a new building is $225,000.

This alternative would reduce the raw water TOC by a small fraction which in turn would reduce the DBPs. However, given CTUB's current exceedance levels, this alternative alone would not be sufficient for completely eliminating the DBP issues.

Alternative No. 8 - Reverse Osmosis

Reverse Osmosis (RO) is a type of membrane filtration with a very tight spiral-wound pore size. This membrane system works under high pressure to filter out the majority of organic based contaminants. The membranes are so tight that they will also reduce water hardness (calcium carbonate). This can lead to the need for blending non-RO water and/or adding antiscalants and corrosion inhibitors to combat the water chemistry change. RO filtration is one of the most preferred methods of treatment to maintain compliance with the current and anticipated future drinking water regulations. This is because it is capable of removing such a wide-range of contaminants.

The main downfall with RO filtration is that on average, 20-25% of the feed water is rejected as concentrated waste (high TOC and hardness). This high volume of wastewater would obviously require an NPDES permit. It would also require a large wastewater holding tank to collect and dispose of the solids. The membrane modules would last 7-10 years, at which time they would need replaced, which is an expensive undertaking. An automated chemical cleaning system is also required as part of the system.

A RO system is extremely effective and would remove almost all of the TOC and DBPs. However, the system would require at least two (2) high pressure (over 100 PSI) booster pumps, prestrainers, stainless steel piping, membrane module racks, an automated chemical clean-in-place system, a PLC based control panel and associated electrical requirements. This equipment would need housed in an estimated 3,000 SF building addition. The total estimated construction cost to implement RO filtration is $2.75-3.25 million. This cost does not include a new wastewater storage tank or NPDES.

This alternative would address the TOC and DBP issues. However, the capital and O&M costs to implement this type of advanced treatment at the current time, may not be feasible.

5.0 RECOMMENDATIONS

The water treatment facility alternatives were evaluated on the basis of both monetary and non-monetary factors. These included present worth, reliability of supply, reliability of operation, energy consumption sustainability, environmental impacts, public acceptability, and future water treatment rules and regulations.

Based on the evaluation, GD&F recommends that first a Phase I Hydrogeological Survey be conducted to seek the potential of new supplemental groundwater sources to blend with the existing Shenandoah River source. GD&F recommends a minimum of 500 gallons per minute of groundwater for blending purposes to achieve a constant goal of less than 2.0 mg/L of TOC in the finished water. If a contamination event were to occur in the Shenandoah River a secondary source would allow CTUB to shutoff the river source rather than the entire treatment plant and further comply with WV Senate Bill 373 which was adopted after the 2014 chemical spill that contaminated the Elk River in Charleston, West Virginia, on January 9, 2014, leaving 300,000 West Virginians without water.

GD&F also recommends CTUB stop recycling backwash water to the head of the plant via an NPDES permit. Stopping the recycle would ensure that excessively turbid water with high TOC levels are not being returned to the head of the plant. Although GD&F looked at this NPDES option preliminarily, further investigation regarding line placement is required. GD&F recommends that a NPDES feasibility study be performed.

In the event that an NPDES permit is unattainable, it is recommended that a sludge handling assessment be performed on the WTP to address the lack of available sludge storage volume. GD&F also recommends investigating alternatives to hauling WTP sludge to CTUB's WWTP for further processing as part of this assessment. It appears that this action has its limitations and is significantly affecting both the WTP and WWTP performance.

If sufficient groundwater wells are developed and the recycling of process wastewater is ceased, CTUB will have better control of DBP issues. However, if only these two (2) alternatives are selected, the ammonia sulfate (chloramination process) would still be required to achieve regulatory DBP limits.

The most cost effective and long-term viable solution to TOC removal and DBP reduction is granular activated carbon filtration. This option alone would remove TOC and DBPs down to a very low level. If this option is selected, chloramination would no longer be required. If CTUB desires to eliminate chloramination, GAC filtration should be considered.

Please refer to Table 3 below for estimated capital construction costs of the alternatives.

Table 3

Estimated Capital Construction Costs of Alternatives

Alternative	Estimated Capital Construction Cost
Groundwater Well Backup Supply[1]	$500,000
Stop Recycling Backwash-NPDES Discharge	$600,000
Granular Activated Carbon	$2.4-$2.75 million
UV Disinfection with Hydrogen Peroxide	$1.7 million
Ozone	$3.5-$4.0 million
Powdered Activated Carbon	$225,000
Reverse Osmosis	$2.75-$3.25 million

1. Assumes two (2) wells at $250,000 per well.

6.0 LIST OF REFERENCES

Black & Veatch. "Charles Town Water Treatment Plant Disinfection By-Product Reduction: Study and Recommendations." Technical Memorandum. (2008) Print.

Environmental Protection Agency . "Disinfectants and Disinfection Byproducts Rules (Stage 1 and Stage 2)." Publication No. EPA815-R-20-005. (2020).

McCormick, N.J., M. Porter and Margaret E. Walsh. " Disinfection By-products In Filter Backwash Water: Implications to Water Quality In Recycle Designs." *Water Research* (2010): 44(15):4581-9.

SBW Consulting, Inc. " Municipal Water Treatment Plant Energy Baseline Study." Study. 2006 Print.

Sung, Windsor, Betsy Reilley-Matthews, D. Kelly O'Day and Kristin Horrigan. "Modeling DBP Formations." (2019). Print.

Terradon Corporation. "Source Water Protection Plan: Charles Town Utility Board." *Journal AWWA* (2002): 57-63.

West Virginia Department of Health and Human Resources, Bureau for Public Health. "Charles Town Utilities Water System." Sanitary Survey. (2015). Print.

APPENDIX A

TOC SAMPLING RESULTS AND
QUARTERLY OPERATIONAL REPORT - DISINFECTION BYPRODUCT

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

November 24, 2020

Kristen Stolipher
CHARLES TOWN UTILITY BOARD - WATER PLANT

,

RE: Project: DBP STUDY - DOC, SUVA, TOC
Pace Project No.: 7350174

Dear Kristen Stolipher:

Enclosed are the analytical results for sample(s) received by the laboratory on November 12, 2020. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:
- Pace Analytical Services - WestVirginia

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Todd Crone
todd.crone@pacelabs.com
800-999-0105
Project Manager

Enclosures

cc: JOE BURRIS, CHARLES TOWN UTILITY BOARD
Chris Hutzler, CHARLES TOWN UTILITY BOARD - WATER PLANT
LARRY STEWART, CHARLES TOWN UTILITY BOARD - WATER PLANT
Ms. Ashley Stottlemyer, CHARLES TOWN UTILITY BOARD

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Pace Analytical Services, LLC
225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

CERTIFICATIONS

Project: DBP STUDY - DOC, SUVA, TOC
Pace Project No.: 7350174

Pace Analytical Services Beaver
225 Industrial Park Drive, Beaver, WV 25813
Virginia VELAP 460148
West Virginia DEP 060
West Virginia DHHR 00412CM
North Carolina DEQ 466
Kentucky Wastewater Certification KY90039
Pennsylvania DEP 68-00839

REPORT OF LABORATORY ANALYSIS

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225 Industrial Park RD
Beaver, WV 25813
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SAMPLE SUMMARY

Project: DBP STUDY - DOC, SUVA, TOC
Pace Project No.: 7350174

Lab ID	Sample ID	Matrix	Date Collected	Date Received
7350174001	SETTLED	Drinking Water	11/11/20 10:45	11/12/20 14:00
7350174002	RAW	Drinking Water	11/11/20 10:40	11/12/20 14:00
7350174003	SLUDGE	Drinking Water	11/11/20 10:50	11/12/20 14:00
7350174004	FILTERED	Drinking Water	11/11/20 10:55	11/12/20 14:00
7350174005	SETTLED	Drinking Water	11/11/20 10:30	11/12/20 14:00
7350174006	RAW DOC/SUVA	Drinking Water	11/11/20 10:40	11/12/20 14:00

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SAMPLE ANALYTE COUNT

Project: DBP STUDY - DOC, SUVA, TOC
Pace Project No.: 7350174

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
7350174001	**SETTLED**	SM 5910B-11	JWJ	1	PASI-BVWV
		SM 5310C-11	JWJ	1	PASI-BVWV
7350174002	**RAW**	SM 5310C-11	JWJ	1	PASI-BVWV
7350174003	**SLUDGE**	SM 5310C-11	JWJ	1	PASI-BVWV
7350174004	**FILTERED**	SM 5310C-11	JWJ	1	PASI-BVWV
7350174005	**SETTLED**	SM 5310C-11	JWJ	1	PASI-BVWV

PASI-BVWV = Pace Analytical Services - WestVirginia

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ANALYTICAL RESULTS

Project: DBP STUDY - DOC, SUVA, TOC
Pace Project No.: 7350174

Sample: SETTLED **Lab ID: 7350174001** Collected: 11/11/20 10:45 Received: 11/12/20 14:00 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
UV254		Analytical Method: SM 5910B-11 Pace Analytical Services - WestVirginia								
U254 UV Absorbing Organic	**0.018**	cm-1	0.0030	0.0030		1		11/13/20 09:22		
5310C Dissolved Organic Carbon		Analytical Method: SM 5310C-11 Pace Analytical Services - WestVirginia								
Dissolved Organic Carbon	**1.4**	mg/L	1.0	0.60		1		11/16/20 19:46		N3

Sample: RAW **Lab ID: 7350174002** Collected: 11/11/20 10:40 Received: 11/12/20 14:00 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
5310C Total Organic Carbon, DW		Analytical Method: SM 5310C-11 Pace Analytical Services - WestVirginia								
Total Organic Carbon	**1.8**	mg/L	1.0	0.60		1		11/16/20 12:16	7440-44-0	

Sample: SLUDGE **Lab ID: 7350174003** Collected: 11/11/20 10:50 Received: 11/12/20 14:00 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
5310C Total Organic Carbon, DW		Analytical Method: SM 5310C-11 Pace Analytical Services - WestVirginia								
Total Organic Carbon	**2.1**	mg/L	1.0	0.60		1		11/16/20 12:28	7440-44-0	

Sample: FILTERED **Lab ID: 7350174004** Collected: 11/11/20 10:55 Received: 11/12/20 14:00 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
5310C Total Organic Carbon, DW		Analytical Method: SM 5310C-11 Pace Analytical Services - WestVirginia								
Total Organic Carbon	**2.4**	mg/L	1.0	0.60		1		11/16/20 12:41	7440-44-0	

Sample: SETTLED **Lab ID: 7350174005** Collected: 11/11/20 10:30 Received: 11/12/20 14:00 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
5310C Total Organic Carbon, DW		Analytical Method: SM 5310C-11 Pace Analytical Services - WestVirginia								
Total Organic Carbon	**1.5**	mg/L	1.0	0.60		1		11/16/20 12:53	7440-44-0	

REPORT OF LABORATORY ANALYSIS

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225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

QUALIFIERS

Project: DBP STUDY - DOC, SUVA, TOC
Pace Project No.: 7350174

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

ANALYTE QUALIFIERS

N3 Accreditation is not offered by the relevant laboratory accrediting body for this parameter.

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225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: DBP STUDY - DOC, SUVA, TOC
Pace Project No.: 7350174

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
7350174001	SETTLED	SM 5910B-11	49367		
7350174002	RAW	SM 5310C-11	49386		
7350174003	SLUDGE	SM 5310C-11	49386		
7350174004	FILTERED	SM 5310C-11	49386		
7350174005	SETTLED	SM 5310C-11	49386		
7350174001	SETTLED	SM 5310C-11	49389		

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WO#:7350174

7350174

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 1 Of 1

Section A — Required Client Information:

Company: CHARLES TOWN UTILITY BOARD
Address: 832 S. GEORGE STREET
Charles Town, WV 25414
Email: chutzler@ctubwv.com
Phone: (304)725-3761 Fax:
Requested Due Date:

Required Project Information:

Report To: Chris Hutzler
Copy To:
Purchase Order #:
Project Name: DBP STUDY - DOC, SUVA, TOC
Project #:

Section C — Invoice Information:

Attention:
Company Name:
Address:
Pace Quote:
Pace Project Manager: todd.crone@pacelabs.com,
Pace Profile #: 4330

Regulatory Agency
State / Location: WV

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID (One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique)	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test Y/N	DOC & UV254	TOC by 5310	Residual Chlorine (Y/N)	
1	Settled		G	11/4/2020			10:45												X			
2	Raw						10:40													X		
3	Sludge						10:50													X		
4	Filtered						10:55													X		
5	Settled						0:30													X		
6																						
7	DOC/SUVA (RAW						10:40															
8	or Raw)																					
9																						
10																						
11																						
12																						Received. 2C 11/4/2020

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
DBP STUDY MAKE 3 OF THESE KITS AND SEND TO CHRIS H. @ CHARLESTOWN		11/12/20	10:40				
		11/4/20	10:40				
		11/4/20	10:55				
			10:45				

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: JR Carper
SIGNATURE of SAMPLER: DATE Signed:

SAMPLE CONDITIONS: TEMP in C | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : 1 Of 1

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	CHARLES TOWN UTILITY BOARD	Report To:	Chris Hutzler	Attention:	
Address:	832 S. GEORGE STREET	Copy To:		Company Name:	
Charles Town, WV 25414				Address:	
Email:	chutzler@clubwv.com	Purchase Order #:		Pace Quote:	
Phone:	(304)725-3761 Fax:	Project Name:	DBP STUDY - DOC, SUVA, TOC	Pace Project Manager:	todd.crone@pacelabs.com,
Requested Due Date:		Project #:		Pace Profile #:	4330

Regulatory Agency: State / Location: WV

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID (One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique)	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test Y/N	DOC & UV254	TOC by 5310	Residual Chlorine (Y/N)
1																			X		
2																				X	
3																				X	
4																				X	
5																				X	
6																					
7																					
8																					
9																					
10																					
11																					
12																					

MATRIX CODE: Drinking Water DW; Water WT; Waste Water WW; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Other OT; Tissue TS

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
DBP STUDY MAKE 3 OF THESE KITS AND SEND TO CHRIS H. @ CHARLESTOWN		11/12/20	10:40		11-12-20	1640	
		11/12/20	1645		11-12-20	1700	
		11/12/20	1650		11-12-20	1730	
					11-12-20	1730	2.1

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: DATE Signed:

TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

WO#: 7350174

PM: DTC Due Date: 11/23/20

CLIENT: CHARTWNUTWP

LIMS73 Lab Sample Condition Upon Receipt (West

Face Analytical

Client Name: _____ 9

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☑ Pace ☐ Other: _____

Tracking #: _____

Custody Seal on Cooler/Box/Containers Present: ☐ yes ☑ no Seals intact: ☐ yes ☐ no

Thermometer Used 23 Type of Ice: (Wet) Blue None

Cooler Temperature Observed Temp 2.1 °C Correction Factor: 0.0 °C Final Temp: 2.1 °C

Comments:

pH paper Lot#	Date and Initials of person examining contents:
223419	FW 11-12-20

	Yes	No	N/A	
Chain of Custody Present:	✓			1.
Chain of Custody Filled Out:	✓			2.
Chain of Custody Relinquished:	✓			3.
Sampler Name & Signature on COC:	✓			4.
Sample Labels match COC: -includes date/time/ID Matrix: liquid	✓			5.
Samples Arrived within Hold Time:	✓			6.
Short Hold Time Analysis (<72hr remaining):	✓			7.
Rush Turn Around Time Requested:		✓		8.
Sufficient Volume:	✓			9.
Correct Containers Used: -Pace Containers Used:	✓ ✓			10.
Containers Intact:	✓			11.
Orthophosphate field filtered:			✓	12.
Hex Cr Aqueous sample field filtered: -pH adjusted within 24 hours? (If yes, indicate acid lot #)			✓ ✓	13.
Filtered volume received for Dissolved tests:			✓	14.
All containers have been checked for preservation: exceptions: VOA, coliform, O&G, LLMercury, Non-aqueous matrix	✓			15.
All containers meet method preservation requirements:	✓			Initial when completed: FW Date/time samples provided to lab: 11-12-20
				Tests not preserved:
Headspace in VOA Vials:			✓	16.
Trip Blank Present:			✓	17.
Trip Blank Custody Seals Present:			✓	
				Initial when completed: FW Date: 11-12-20

Client Notification/ Resolution:

Person Contacted: _____ Date/Time: _____ Contacted By: _____

Comments/ Resolution: _____

☐ A check in this box indicates that additional information has been stored in ereports.

*PM review is documented electronically in LIMS, when the Project Manager closes the SRF Review schedule in LIMS. The status may be reviewed in the Status section of the Workorder Edit Screen.

Pace Analytical Services, LLC
225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

December 08, 2020

Kristen Stolipher
CHARLES TOWN UTILITY BOARD - WATER PLANT

,

RE: Project: DBP STUDY-DOC,SUVA,TOC
Pace Project No.: 7350563

Dear Kristen Stolipher:

Enclosed are the analytical results for sample(s) received by the laboratory on November 17, 2020. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:
- Pace Analytical Services - WestVirginia

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Todd Crone
todd.crone@pacelabs.com
800-999-0105
Project Manager

Enclosures

cc: JOE BURRIS, CHARLES TOWN UTILITY BOARD
Chris Hutzler, CHARLES TOWN UTILITY BOARD - WATER PLANT
LARRY STEWART, CHARLES TOWN UTILITY BOARD - WATER PLANT
Ms. Ashley Stottlemyer, CHARLES TOWN UTILITY BOARD

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, LLC
225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

CERTIFICATIONS

Project: DBP STUDY-DOC,SUVA,TOC
Pace Project No.: 7350563

Pace Analytical Services Beaver
225 Industrial Park Drive, Beaver, WV 25813
Virginia VELAP 460148
West Virginia DEP 060
West Virginia DHHR 00412CM
North Carolina DEQ 466
Kentucky Wastewater Certification KY90039
Pennsylvania DEP 68-00839

REPORT OF LABORATORY ANALYSIS

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225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

SAMPLE SUMMARY

Project: DBP STUDY-DOC,SUVA,TOC
Pace Project No.: 7350563

Lab ID	Sample ID	Matrix	Date Collected	Date Received
7350563001	RAW	Drinking Water	11/16/20 08:30	11/17/20 17:25
7350563002	SETTLED	Drinking Water	11/16/20 08:30	11/17/20 17:25
7350563003	FILTERED	Drinking Water	11/16/20 08:30	11/17/20 17:25
7350563004	SLUDGE	Drinking Water	11/16/20 08:30	11/17/20 17:25

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225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

SAMPLE ANALYTE COUNT

Project: DBP STUDY-DOC,SUVA,TOC
Pace Project No.: 7350563

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
7350563001	**RAW**	SM 5910B-11	JWJ	1	PASI-BVWV
		SUVA Calculation	JWJ	1	PASI-BVWV
		SM 5310C-11	JWJ	1	PASI-BVWV
		SM 5310C-11	JWJ	1	PASI-BVWV
7350563002	**SETTLED**	SM 5310C-11	JWJ	1	PASI-BVWV
7350563003	**FILTERED**	SM 5310C-11	JWJ	1	PASI-BVWV
7350563004	**SLUDGE**	SM 5310C-11	JWJ	1	PASI-BVWV

PASI-BVWV = Pace Analytical Services - WestVirginia

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Pace Analytical Services, LLC
225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

ANALYTICAL RESULTS

Project: DBP STUDY-DOC,SUVA,TOC
Pace Project No.: 7350563

Sample: RAW **Lab ID: 7350563001** Collected: 11/16/20 08:30 Received: 11/17/20 17:25 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
UV254		Analytical Method: SM 5910B-11 Pace Analytical Services - WestVirginia								
U254 UV Absorbing Organic	**0.13**	cm-1	0.0030	0.0030		1		11/18/20 07:57		
Specific UV Absorbance		Analytical Method: SUVA Calculation Pace Analytical Services - WestVirginia								
Specific UV Absorbance	**3.2**	L/mg-M				1		12/03/20 06:32		
5310C Total Organic Carbon, DW		Analytical Method: SM 5310C-11 Pace Analytical Services - WestVirginia								
Total Organic Carbon	**4.3**	mg/L	1.0	0.60		1		11/18/20 13:36	7440-44-0	
5310C Dissolved Organic Carbon		Analytical Method: SM 5310C-11 Pace Analytical Services - WestVirginia								
Dissolved Organic Carbon	**4.0**	mg/L	1.0	0.60		1		12/07/20 15:36		N3

Sample: SETTLED **Lab ID: 7350563002** Collected: 11/16/20 08:30 Received: 11/17/20 17:25 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
5310C Total Organic Carbon, DW		Analytical Method: SM 5310C-11 Pace Analytical Services - WestVirginia								
Total Organic Carbon	**3.0**	mg/L	1.0	0.60		1		11/18/20 13:50	7440-44-0	

Sample: FILTERED **Lab ID: 7350563003** Collected: 11/16/20 08:30 Received: 11/17/20 17:25 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
5310C Total Organic Carbon, DW		Analytical Method: SM 5310C-11 Pace Analytical Services - WestVirginia								
Total Organic Carbon	**2.7**	mg/L	1.0	0.60		1		11/18/20 14:02	7440-44-0	

Sample: SLUDGE **Lab ID: 7350563004** Collected: 11/16/20 08:30 Received: 11/17/20 17:25 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
5310C Total Organic Carbon, DW		Analytical Method: SM 5310C-11 Pace Analytical Services - WestVirginia								
Total Organic Carbon	**27.7**	mg/L	1.0	0.60		1		11/18/20 14:17	7440-44-0	

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Pace Analytical Services, LLC
225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

QUALIFIERS

Project: DBP STUDY-DOC,SUVA,TOC
Pace Project No.: 7350563

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

ANALYTE QUALIFIERS

N3 Accreditation is not offered by the relevant laboratory accrediting body for this parameter.

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Pace Analytical Services, LLC
225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: DBP STUDY-DOC,SUVA,TOC
Pace Project No.: 7350563

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
7350563001	RAW	SM 5910B-11	49829		
7350563001	RAW	SUVA Calculation	51070		
7350563001	RAW	SM 5310C-11	49830		
7350563002	SETTLED	SM 5310C-11	49830		
7350563003	FILTERED	SM 5310C-11	49830		
7350563004	SLUDGE	SM 5310C-11	49830		
7350563001	RAW	SM 5310C-11	51552		

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WO# : 7350563

7350563

USTODY / Analytical Request Document

y is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : 1 Of 1

Section A — Required Client Information:

Company:	CHARLES TOWN UTILITY BOARD
Address:	832 S. GEORGE STREET
	Charles Town, WV 25414
Email:	chutzler@ctubwv.com
Phone:	(304)725-3761 Fax:
Requested Due Date:	

Section B — Information:

Report To:	Chris Hutzler
Copy To:	
Purchase Order #:	
Project Name:	DBP STUDY - DOC, SUVA, TOC
Project #:	

ection C — Invoice Information:

Attention:	
Company Name:	
Address:	
Pace Quote:	
Pace Project Manager:	todd.crone@pacelabs.com,
Pace Profile #:	4330

Regulatory Agency:

State / Location: WV

MATRIX CODE: Drinking Water DW; Water WT; Waste Water WW; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Other OT; Tissue TS

ITEM #	SAMPLE ID (One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique)	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	START TIME	END DATE	END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test Y/N	DOC & UV254	TOC by 5310	Residual Chlorine (Y/N)
1	Raw			11-16-20	830	11-16-20	830	2		X	X								X	X	
2	Settled			11-16-20	830	11-16-20	830	↓			X								X	X	
3	Filtered			11-16-20	830	11-16-20	830				X									X	
4	Sludge			11-16-20	830	11-16-20	830	↓			X									X	
5								-												X	
6																					
7																					
8																					
9																					
10																					
11																					
12																					

Requested Analysis Filtered (Y/N)

★Percont. 2C 11/17/2020

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
DBP STUDY MAKE 3 OF THESE KITS AND SEND TO CHRIS H. @ CHARLESTOWN		11-16-20	17:00		11/17/2020	1000	
	Larry Stewart	11-17-20	8:30am		11-17-2020	1400	
		11-17-20	10:00		11-17-20	2PM	
		11/17/2020	1100		11-17-2C	1550	

11-17-2C 1725

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Chris Hutzler

SIGNATURE of SAMPLER: DATE Signed: 11-16-20

11-17-20 1725

TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

LIMS73 Lab Sample Condition Upon Receipt (West Virg

WO#: 7350563

PM: DTC Due Date: 12/01/20

CLIENT: CHARTWNUTWP

Pace Analytical

Client Name: _____

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☑ Pace ☐ Other: _____

Tracking #: _____

Custody Seal on Cooler/Box/Containers Present: ☐ yes ☑ no Seals intact: ☐ yes ☐ no

Thermometer Used 23 Type of Ice: Wet Blue (None)

Cooler Temperature Observed Temp 1.7 °C Correction Factor: 0.0 °C Final Temp: 1.7 °C

Comments:

pH paper Lot#	Date and Initials of person examining contents:
223419	FW 11-17-20

	Yes	No	N/A	
Chain of Custody Present:	✓			1.
Chain of Custody Filled Out:	✓			2.
Chain of Custody Relinquished:	✓			3.
Sampler Name & Signature on COC:	✓			4.
Sample Labels match COC: -Includes date/time/ID Matrix: liquid	✓			5.
Samples Arrived within Hold Time:	✓			6.
Short Hold Time Analysis (<72hr remaining):	✓			7.
Rush Turn Around Time Requested:		✓		8.
Sufficient Volume:	✓			9.
Correct Containers Used: -Pace Containers Used:	✓ ✓			10.
Containers Intact:	✓			11.
Orthophosphate field filtered:			✓	12.
Hex Cr Aqueous sample field filtered: -pH adjusted within 24 hours? (If yes, indicate acid lot #)			✓ ✓	13.
Filtered volume received for Dissolved tests:			✓	14.
All containers have been checked for preservation: exceptions: VOA, coliform, O&G, LLMercury, Non-aqueous matrix	✓			15.
All containers meet method preservation requirements:	✓			Initial when completed: FW Date/time samples provided to lab: 11-17-20
				Tests not preserved:
Headspace in VOA Vials:			✓	16.
Trip Blank Present:			✓	17.
Trip Blank Custody Seals Present:			✓	
				Initial when completed: FW Date: 11-17-20

Client Notification/ Resolution:

Person Contacted: _____ Date/Time: _____ Contacted By: _____

Comments/ Resolution: _____

☐ **A check in this box indicates that additional information has been stored in ereports.**

*PM review is documented electronically in LIMS, when the Project Manager closes the SRF Review schedule in LIMS. The status may be reviewed in the Status section of the Workorder Edit Screen.

SCUR_WV - rev.082219

QUARTERLY OPERATIONAL REPORT - DISINFECTION BYPRODUCT

EW-90C Revised 02/05

QUARTERLY OPERATIONAL REPORT
DISINFECTION BYPRODUCT
PRECURSORS CONTROL
(GWUDI)

PWSID NUMBER: WV 330-1905 (Required)

QUARTER/YEAR 4th 2019

System Name CHARLES TOWN WATER DEPARTMENT **County** JEFFERSON

Treatment Plant Name

Month	Source Water		Treated Water TOC (mg/L)	(A) Actual % TOC Removal	(B) Required% TOC Removal	(C) Removal Ratio (A) / (B)	Basis for Required % Removal
	ALK (mg/L)	TOC (mg/L)					
Jan-19	120.0	1.5	1.2	18%	25%	0.7	A1
Feb-19	127.0	1.0	0.8	24%	15%	1.6	A1
Mar-19	112.0	1.5	1.1	28%	25%	1.1	A1
Apr-19	136.0	1.5	1.0	33%	15%	2.2	A1
May-19	97.4	3.8	2.6	31%	25%	1.2	A1
Jun-19	151.0	2.1	1.5	28%	15%	1.9	A1
July-19	148.0	2.8	1.8	35%	15%	2.3	A1
Aug-19	133.0	2.4	2.2	6%	15%	0.4	A1
Sep-19	152.0	2.7	1.8	33%	15%	2.2	A1
Oct-19	158.0	3.0	2.1	32%	15%	2.1	A1
Nov-19	198.0	3.7	2.7	28%	15%	1.9	A1
Dec-19	182.0	2.0	1.4	31%	15%	2.1	A1
Total	1714.4	28.0	20.2	3.3	2.1	19.7	
Annual Average	142.9	2.3	1.7	0.3	0.2	1.6	

CERTIFIED BY: Chris Hutzler
(Certified Operator's Printed Name Required)

(Certified Operator's Signature Required) Date: 1/2/2020

Certification # WVOP03529 Exp. Date October 31, 2019

Certification Class 3 Telephone Number 304-725-3761

Complete and return within 10 days after the end of the quarter to:
WV Office of Environmental Health Services RD&C Unit
Capitol and Washington Streets, 1 Davis Square, Suite 200, Charleston, WV 25301-1798
Phone: (304) 558-2981 FAX: (304) 558-0139

EW-90C Revised 02/05

QUARTERLY OPERATIONAL REPORT
DISINFECTION BYPRODUCT
PRECURSORS CONTROL
(GWUDI)

PWSID NUMBER: WV 330-1905 (Required)

QUARTER/YEAR 4th 2020

System Name CHARLES TOWN WATER DEPARTMENT **County** JEFFERSON

Treatment Plant Name

Month	Source Water		Treated Water TOC (mg/L)	(A) Actual % TOC Removal	(B) Required% TOC Removal	(C) Removal Ratio (A) / (B)	Basis for Required % Removal
	ALK (mg/L)	TOC (mg/L)					
January-20	137.0	2.6	1.9	27%	15%	1.8	A1
February-20	114.0	2.7	2.0	28%	25%	1.1	A1
March-20	125.0	2.5	1.4	46%	15%	3.0	A1
April-20	113.0	3.0	1.8	41%	25%	1.6	A1
May-20	105.0	2.5	1.8	29%	25%	1.1	A1
June-20	79.0	2.7	1.4	48%	25%	1.9	A1
July-20	105.0	3.8	2.6	32%	25%	1.3	A1
August-20	98.0	4.9	3.6	26%	25%	1.0	A1
September-20	103.0	3.8	2.2	42%	25%	1.7	A1
Oct-20	111.0	3.4	2.2	34%	25%	1.4	A1
Nov-20	118.0	3.5	2.2	38%	25%	1.5	A1
Dec-20	104.0	5.3	2.3	57%	35%	1.6	A1
Total	1312.0	40.7	25.3	4.5	2.9	19.2	
Annual Average	109.3	3.4	2.1	0.4	0.2	1.6	

CERTIFIED BY: Chris Hutzler
(Certified Operator's Printed Name Required)

(Certified Operator's Signature Required) Date: 1/4/2021

Certification # WVOP03529 Exp. Date October 31, 2021

Certification Class 3 Telephone Number 304-725-3761

Complete and return within 10 days after the end of the quarter to:
WV Office of Environmental Health Services RD&C Unit
Capitol and Washington Streets, 1 Davis Square, Suite 200, Charleston, WV 25301-1798
Phone: (304) 558-2981 FAX: (304) 558-0139

APPENDIX B

TTHM & HAA5 SAMPLING RESULTS AND CONSUMER CONFIDENCE REPORTS

Pace Analytical Services, LLC
225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

October 19, 2020

Kristen Stolipher
CHARLES TOWN UTILITY BOARD - WATER PLANT

,

RE: Project: WATER PLANT - WV3301905
Pace Project No.: 7345474

Dear Kristen Stolipher:

Enclosed are the analytical results for sample(s) received by the laboratory on October 06, 2020. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:

- Pace Analytical Services - WestVirginia
- Pace Analytical Services - Ormond Beach

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Todd Crone
todd.crone@pacelabs.com
800-999-0105
Project Manager

Enclosures

cc: JOE BURRIS, CHARLES TOWN UTILITY BOARD
Charles Hutzler
LARRY STEWART, CHARLES TOWN UTILITY BOARD - WATER PLANT
Ms. Ashley Stottlemyer, CHARLES TOWN UTILITY BOARD

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, LLC
225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

CERTIFICATIONS

Project: WATER PLANT - WV3301905
Pace Project No.: 7345474

Pace Analytical Services Ormond Beach
8 East Tower Circle, Ormond Beach, FL 32174
Alaska DEC- CS/UST/LUST
Alabama Certification #: 41320
Arizona Certification# AZ0819
Colorado Certification: FL NELAC Reciprocity
Connecticut Certification #: PH-0216
Delaware Certification: FL NELAC Reciprocity
Florida Certification #: E83079
Georgia Certification #: 955
Guam Certification: FL NELAC Reciprocity
Hawaii Certification: FL NELAC Reciprocity
Illinois Certification #: 200068
Indiana Certification: FL NELAC Reciprocity
Kansas Certification #: E-10383
Kentucky Certification #: 90050
Louisiana Certification #: FL NELAC Reciprocity
Louisiana Environmental Certificate #: 05007
Maryland Certification: #346
Michigan Certification #: 9911
Mississippi Certification: FL NELAC Reciprocity
Missouri Certification #: 236
Montana Certification #: Cert 0074
Nebraska Certification: NE-OS-28-14
New Hampshire Certification #: 2958
New Jersey Certification #: FL022
New York Certification #: 11608
North Carolina Environmental Certificate #: 667
North Carolina Certification #: 12710
North Dakota Certification #: R-216
Ohio DEP 87780
Oklahoma Certification #: D9947
Pennsylvania Certification #: 68-00547
Puerto Rico Certification #: FL01264
South Carolina Certification: #96042001
Tennessee Certification #: TN02974
Texas Certification: FL NELAC Reciprocity
US Virgin Islands Certification: FL NELAC Reciprocity
Virginia Environmental Certification #: 460165
West Virginia Certification #: 9962C
Wisconsin Certification #: 399079670
Wyoming (EPA Region 8): FL NELAC Reciprocity

Pace Analytical Services Beaver
225 Industrial Park Drive, Beaver, WV 25813
Virginia VELAP 460148
West Virginia DEP 060
West Virginia DHHR 00412CM
North Carolina DEQ 466
Kentucky Wastewater Certification KY90039
Pennsylvania DEP 68-00839

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Pace Analytical Services, LLC
225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

SAMPLE SUMMARY

Project: WATER PLANT - WV3301905
Pace Project No.: 7345474

Lab ID	Sample ID	Matrix	Date Collected	Date Received
7345474001	WATER PLANT	Drinking Water	10/06/20 07:45	10/06/20 18:20
7345474002	TRIP BLANK	Drinking Water	10/06/20 07:45	10/06/20 18:20

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, LLC
225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

SAMPLE ANALYTE COUNT

Project: WATER PLANT - WV3301905
Pace Project No.: 7345474

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
7345474001	**WATER PLANT**	EPA 552.2	WWM	7	PASI-BVWV
		EPA 524.2	CMH	8	PASI-O
7345474002	**TRIP BLANK**	EPA 524.2	CMH	8	PASI-O

PASI-BVWV = Pace Analytical Services - WestVirginia
PASI-O = Pace Analytical Services - Ormond Beach

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Pace Analytical Services, LLC
225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

ANALYTICAL RESULTS

Project: WATER PLANT - WV3301905
Pace Project No.: 7345474

Sample: WATER PLANT **Lab ID: 7345474001** Collected: 10/06/20 07:45 Received: 10/06/20 18:20 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
5522 Haloacetic Acids	Analytical Method: EPA 552.2 Preparation Method: EPA 552.2 Pace Analytical Services - WestVirginia									
Dibromoacetic acid	ND	ug/L	1.0	0.50		1	10/15/20 07:04	10/15/20 16:26	631-64-1	M5
Dichloroacetic acid	**15.6**	ug/L	1.0	0.50		1	10/15/20 07:04	10/15/20 16:26	79-43-6	M5
Haloacetic Acids (Total)	**36.5**	ug/L	1.0	1.0		1	10/15/20 07:04	10/15/20 16:26		M5
Monobromoacetic Acid	ND	ug/L	1.0	0.50		1	10/15/20 07:04	10/15/20 16:26	79-08-3	M5
Monochloracetic acid	ND	ug/L	1.0	0.50		1	10/15/20 07:04	10/15/20 16:26	79-11-8	M5
Trichloroacetic Acid	**20.9**	ug/L	1.0	0.50		1	10/15/20 07:04	10/15/20 16:26	76-03-9	M5
Surrogates										
2,3-Dibromopropanoic Acid (S)	157	%.	70-130			1	10/15/20 07:04	10/15/20 16:26	600-05-5	M5,S2
524.2 THM	Analytical Method: EPA 524.2 Pace Analytical Services - Ormond Beach									
Bromodichloromethane	**6.7**	ug/L	1.0	0.37		1		10/14/20 16:19	75-27-4	
Bromoform	ND	ug/L	1.0	0.35		1		10/14/20 16:19	75-25-2	
Chloroform	**27.5**	ug/L	1.0	0.37		1		10/14/20 16:19	67-66-3	
Dibromochloromethane	**0.71J**	ug/L	1.0	0.47		1		10/14/20 16:19	124-48-1	
Total Trihalomethanes (Calc.)	**34.9**	ug/L	1.0	0.47	80	1		10/14/20 16:19		
Surrogates										
4-Bromofluorobenzene (S)	92	%	70-130			1		10/14/20 16:19	460-00-4	
Toluene-d8 (S)	97	%	70-130			1		10/14/20 16:19	2037-26-5	
1,2-Dichlorobenzene-d4 (S)	103	%	70-130			1		10/14/20 16:19	2199-69-1	

Sample: TRIP BLANK **Lab ID: 7345474002** Collected: 10/06/20 07:45 Received: 10/06/20 18:20 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
524.2 THM	Analytical Method: EPA 524.2 Pace Analytical Services - Ormond Beach									
Bromodichloromethane	ND	ug/L	1.0	0.37		1		10/14/20 17:07	75-27-4	
Bromoform	ND	ug/L	1.0	0.35		1		10/14/20 17:07	75-25-2	
Chloroform	ND	ug/L	1.0	0.37		1		10/14/20 17:07	67-66-3	
Dibromochloromethane	ND	ug/L	1.0	0.47		1		10/14/20 17:07	124-48-1	
Total Trihalomethanes (Calc.)	ND	ug/L	1.0	0.47	80	1		10/14/20 17:07		
Surrogates										
4-Bromofluorobenzene (S)	94	%	70-130			1		10/14/20 17:07	460-00-4	
Toluene-d8 (S)	100	%	70-130			1		10/14/20 17:07	2037-26-5	
1,2-Dichlorobenzene-d4 (S)	104	%	70-130			1		10/14/20 17:07	2199-69-1	

REPORT OF LABORATORY ANALYSIS

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225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

QUALIFIERS

Project: WATER PLANT - WV3301905
Pace Project No.: 7345474

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

BATCH QUALIFIERS

Batch: 45921

[M5] A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

ANALYTE QUALIFIERS

M5 A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

S2 Surrogate recovery outside laboratory control limits due to matrix interferences (confirmed by similar results from sample re-analysis).

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Beaver, WV 25813
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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: WATER PLANT - WV3301905
Pace Project No.: 7345474

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
7345474001	**WATER PLANT**	EPA 552.2	45828	EPA 552.2	45921
7345474001	**WATER PLANT**	EPA 524.2	673344		
7345474002	**TRIP BLANK**	EPA 524.2	673344		

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CHAIN OF CUSTODY RECORD

WO# : 7345474

7345474

V13-0516 Pace use ONLY CLIENT ID CHA028 DATE _____ SHEET _____

Client: Charles Town Utility Board PO # _____

Contact Person Chris Hutzler chutzler@ctubwv.com Phone 304-261-4244

Address 832 S George St City Charles Town State WV Zip 25414

Billing Address (if different) _____

City _____ State _____ Zip _____

Site ID & State _____ Proj ID _____ Sampler Larry Stewart

MAIN WV LABORATORY
P.O. Box 286 • 225 Industrial Park Rd, Beaver, WV 25813
800-999-0105 • 304-255-2500 • www.pacelabs.com

LEXINGTON Service Center
782 N Lee Hwy
Lexington, VA 24450
540-777-1276

MORGANTOWN Service Center
16 Commerce Drive
Westover, WV 26501
304-241-5861

ANALYSIS & METHOD REQUESTED: TTHM, HAA5

TURNAROUND TIME: (•) NORMAL ( ) RUSH TURNAROUND* ( ) 5 DAY ( ) 3 DAY ( ) 2 DAY ( ) 1 DAY
*Rush work needs prior laboratory approval and will incur additional charges

Send Results Via: (•) Email ( ) Fax

All analytical requests are subject to Pace's Standard Terms and Conditions.

SAMPLE ID	No. & Type of Containers	Sampling Date/Time	Matrix	Sample Comp/Grab	*1 b7	*9 b	a b	a b	a b	a b	a b	a b
Water Plant	6GV	10-6-20 7:45am	D Water	Grab	X	X						
Trip Blank	1GV		Liquid	Grab	X							

ENTER PRESERVATIVE CODE(S):
0 None
1 Hydrochloric Acid
2 Nitric Acid
3 Sulfuric Acid
4 Sodium Thiosulfate
5 Sodium Hydroxide/ Sodium Arsenite
6 Sodium Hydroxide
7 Ascorbic Acid
8 Sodium Bisulfate/Methanol
9 Ammonium Chloride
10 CR6 Buffer
11 Sodium Sulfite/ Hydrochloric Acid
12 _____ *
*(Use blank for a preservative not listed.)

COMMENTS:

CUSTODY SEALS [ ]Y [ ]N

Corrected temp at arrival: °C ICED? Y N IR # _____ Containers provided by: [ ]Pace [ ]Client Delivered by: [ ]Client [ ]Pace [ ]UPS [ ]FedEx [ ]USPS

RELD Larry Stewart	Date/Time 10-6-20 8:11	RELD		Date/Time 10/6/20 1400	RELD	2 10-6-20	Date/Time 1820
REC'D	Date/Time 10-6-20 10:00	REC'D		Date/Time 10/6/20 1600	REC'D		Date/Time 10-6-2020 1820
RELD	Date/Time 6-20	RELD		Date/Time	RELD		Date/Time
REC'D	Date/Time	REC'D	2 10-6-20	Date/Time 1650	REC'D		Date/Time

LIMS73 Lab Sample Condition Upon Receipt (West Virginia)

Pace Analytical

Client Name: _____

WO#: 7345474

PM: DTC Due Date: 10/21/20

CLIENT: CHARTWNUTWP

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☑ Pace

Tracking #: _____

Custody Seal on Cooler/Box/Containers Present: ☐ yes ☑ no Seals intact: ☐ yes ☐ no

Thermometer Used 9 Type of Ice: (Wet) Blue None

Cooler Temperature Observed Temp 3.5 °C Correction Factor: -0.3 °C Final Temp: 3.2 °C

Comments:

pH paper Lot#	Date and Initials of person examining contents:
—	10/19/2020 ZC

	Yes	No	N/A	
Chain of Custody Present:	✓			1.
Chain of Custody Filled Out:	✓			2.
Chain of Custody Relinquished:	✓			3.
Sampler Name & Signature on COC:	✓			4.
Sample Labels match COC: -Includes date/time/ID Matrix: DW	✓			5.
Samples Arrived within Hold Time:	✓			6.
Short Hold Time Analysis (<72hr remaining):		✓		7.
Rush Turn Around Time Requested:		✓		8.
Sufficient Volume:	✓			9.
Correct Containers Used:	✓			10.
-Pace Containers Used:	✓			
Containers Intact:	✓			11.
Orthophosphate field filtered:			✓	12.
Hex Cr Aqueous sample field filtered:			✓	13.
-pH adjusted within 24 hours? (If yes, indicate acid lot #)			✓	
Filtered volume received for Dissolved tests:			✓	14.
All containers have been checked for preservation: exceptions: VOA, coliform, O&G, LLMercury, Non-aqueous matrix			✓	15.
All containers meet method preservation requirements:			✓	Initial when completed: ZC Date/time samples provided to lab: 10/19/2020
				Tests not preserved:
Headspace in VOA Vials:		✓		16.
Trip Blank Present:	✓			17.
Trip Blank Custody Seals Present:	✓			
				Initial when completed: ZC Date: 10/19/2020

Client Notification/ Resolution:

Person Contacted: _____ Date/Time: _____ Contacted By: _____

Comments/ Resolution: _____

☐ A check in this box indicates that additional information has been stored in ereports.

*PM review is documented electronically in LIMS, when the Project Manager closes the SRF Review schedule in LIMS. The status may be reviewed in the Status section of the Workorder Edit Screen.

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www.pacelabs.com

Pace Analytical Services, LLC
225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

November 23, 2020

Kristen Stolipher
CHARLES TOWN UTILITY BOARD - WATER PLANT

,

RE: Project: DBP STUDY-TTHM/HAA5-WV3301905
Pace Project No.: 7350147

Dear Kristen Stolipher:

Enclosed are the analytical results for sample(s) received by the laboratory on November 12, 2020. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:

- Pace Analytical Services - WestVirginia
- Pace Analytical Services - Ormond Beach

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Todd Crone
todd.crone@pacelabs.com
800-999-0105
Project Manager

Enclosures

cc: JOE BURRIS, CHARLES TOWN UTILITY BOARD
Chris Hutzler, CHARLES TOWN UTILITY BOARD - WATER PLANT
LARRY STEWART, CHARLES TOWN UTILITY BOARD - WATER PLANT
Ms. Ashley Stottlemyer, CHARLES TOWN UTILITY BOARD

NELAP ACCREDITED TNI LABORATORY

REPORT OF LABORATORY ANALYSIS

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225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

CERTIFICATIONS

Project: DBP STUDY-TTHM/HAA5-WV3301905
Pace Project No.: 7350147

Pace Analytical Services Ormond Beach
8 East Tower Circle, Ormond Beach, FL 32174
Alaska DEC- CS/UST/LUST
Alabama Certification #: 41320
Arizona Certification# AZ0819
Colorado Certification: FL NELAC Reciprocity
Connecticut Certification #: PH-0216
Delaware Certification: FL NELAC Reciprocity
Florida Certification #: E83079
Georgia Certification #: 955
Guam Certification: FL NELAC Reciprocity
Hawaii Certification: FL NELAC Reciprocity
Illinois Certification #: 200068
Indiana Certification: FL NELAC Reciprocity
Kansas Certification #: E-10383
Kentucky Certification #: 90050
Louisiana Certification #: FL NELAC Reciprocity
Louisiana Environmental Certificate #: 05007
Maryland Certification: #346
Michigan Certification #: 9911
Mississippi Certification: FL NELAC Reciprocity
Missouri Certification #: 236
Montana Certification #: Cert 0074
Nebraska Certification: NE-OS-28-14
New Hampshire Certification #: 2958
New Jersey Certification #: FL022
New York Certification #: 11608
North Carolina Environmental Certificate #: 667
North Carolina Certification #: 12710
North Dakota Certification #: R-216
Ohio DEP 87780
Oklahoma Certification #: D9947
Pennsylvania Certification #: 68-00547
Puerto Rico Certification #: FL01264
South Carolina Certification: #96042001
Tennessee Certification #: TN02974
Texas Certification: FL NELAC Reciprocity
US Virgin Islands Certification: FL NELAC Reciprocity
Virginia Environmental Certification #: 460165
West Virginia Certification #: 9962C
Wisconsin Certification #: 399079670
Wyoming (EPA Region 8): FL NELAC Reciprocity

Pace Analytical Services Beaver
225 Industrial Park Drive, Beaver, WV 25813
Virginia VELAP 460148
West Virginia DEP 060
West Virginia DHHR 00412CM
North Carolina DEQ 466
Kentucky Wastewater Certification KY90039
Pennsylvania DEP 68-00839

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SAMPLE SUMMARY

Project: DBP STUDY-TTHM/HAA5-WV3301905
Pace Project No.: 7350147

Lab ID	Sample ID	Matrix	Date Collected	Date Received
7350147001	HW MAIN ST.	Drinking Water	11/11/20 08:56	11/12/20 17:30
7350147002	WATER PAINT	Drinking Water	11/11/20 08:40	11/12/20 17:30
7350147003	TUBCAWILLA HILLS	Drinking Water	11/11/20 09:11	11/12/20 17:30
7350147004	BOUHDRY ST	Drinking Water	11/11/20 09:26	11/12/20 17:30
7350147005	MOOSE LODGE	Drinking Water	11/11/20 09:40	11/12/20 17:30
7350147006	TRIP BLANK	Drinking Water	11/11/20 00:00	11/12/20 17:30

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SAMPLE ANALYTE COUNT

Project: DBP STUDY-TTHM/HAA5-WV3301905
Pace Project No.: 7350147

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
7350147001	HW MAIN ST.	EPA 552.3	TSW	7	PASI-O
		EPA 524.2	CLS	7	PASI-BVWV
7350147002	WATER PAINT	EPA 552.3	TSW	7	PASI-O
		EPA 524.2	CLS	7	PASI-BVWV
7350147003	TUBCAWILLA HILLS	EPA 552.3	TSW	7	PASI-O
		EPA 524.2	CLS	7	PASI-BVWV
7350147004	BOUHDRY ST	EPA 552.3	TSW	7	PASI-O
		EPA 524.2	CLS	7	PASI-BVWV
7350147005	MOOSE LODGE	EPA 552.3	TSW	7	PASI-O
		EPA 524.2	CLS	7	PASI-BVWV
7350147006	TRIP BLANK	EPA 524.2	CLS	7	PASI-BVWV

PASI-BVWV = Pace Analytical Services - WestVirginia
PASI-O = Pace Analytical Services - Ormond Beach

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Beaver, WV 25813
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ANALYTICAL RESULTS

Project: DBP STUDY-TTHM/HAA5-WV3301905
Pace Project No.: 7350147

Sample: HW MAIN ST. **Lab ID: 7350147001** Collected: 11/11/20 08:56 Received: 11/12/20 17:30 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
552.3 Haloacetic Acids	Analytical Method: EPA 552.3 Preparation Method: EPA 552.3 Pace Analytical Services - Ormond Beach									
Dibromoacetic Acid	ND	ug/L	1.0	0.43	60	1	11/17/20 10:18	11/21/20 04:20	631-64-1	
Dichloroacetic Acid	**5.3**	ug/L	1.0	0.24	60	1	11/17/20 10:18	11/21/20 04:20	79-43-6	
Haloacetic Acids (Total)	**18.5**	ug/L	1.0	0.90	60	1	11/17/20 10:18	11/21/20 04:20		
Monobromoacetic Acid	ND	ug/L	1.0	0.29	60	1	11/17/20 10:18	11/21/20 04:20	79-08-3	
Monochloroacetic Acid	ND	ug/L	1.0	0.90	60	1	11/17/20 10:18	11/21/20 04:20	79-11-8	
Trichloroacetic Acid	**13.2**	ug/L	1.0	0.26	60	1	11/17/20 10:18	11/21/20 04:20	76-03-9	
Surrogates										
2,3-Dibromopropanoic Acid (S)	105	%	70-130			1	11/17/20 10:18	11/21/20 04:20	600-05-5	
524.2 MSV	Analytical Method: EPA 524.2 Pace Analytical Services - WestVirginia									
Bromodichloromethane	**4.6**	ug/L	0.50	0.14		1		11/13/20 13:56	75-27-4	
Bromoform	ND	ug/L	0.50	0.21		1		11/13/20 13:56	75-25-2	
Chloroform	**29.3**	ug/L	0.50	0.13		1		11/13/20 13:56	67-66-3	
Dibromochloromethane	**0.24J**	ug/L	0.50	0.11		1		11/13/20 13:56	124-48-1	
Total Trihalomethanes (Calc.)	**33.9**	ug/L	0.50			1		11/13/20 13:56		
Surrogates										
4-Bromofluorobenzene (S)	89	%.	70-130			1		11/13/20 13:56	460-00-4	
1,2-Dichlorobenzene-d4 (S)	99	%.	70-130			1		11/13/20 13:56	2199-69-1	

Sample: WATER PAINT **Lab ID: 7350147002** Collected: 11/11/20 08:40 Received: 11/12/20 17:30 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
552.3 Haloacetic Acids	Analytical Method: EPA 552.3 Preparation Method: EPA 552.3 Pace Analytical Services - Ormond Beach									
Dibromoacetic Acid	ND	ug/L	1.0	0.43	60	1	11/17/20 10:18	11/21/20 05:44	631-64-1	
Dichloroacetic Acid	**13.2**	ug/L	1.0	0.24	60	1	11/17/20 10:18	11/21/20 05:44	79-43-6	
Haloacetic Acids (Total)	**30.3**	ug/L	1.0	0.90	60	1	11/17/20 10:18	11/21/20 05:44		
Monobromoacetic Acid	ND	ug/L	1.0	0.29	60	1	11/17/20 10:18	11/21/20 05:44	79-08-3	
Monochloroacetic Acid	ND	ug/L	1.0	0.90	60	1	11/17/20 10:18	11/21/20 05:44	79-11-8	
Trichloroacetic Acid	**17.2**	ug/L	1.0	0.26	60	1	11/17/20 10:18	11/21/20 05:44	76-03-9	
Surrogates										
2,3-Dibromopropanoic Acid (S)	107	%	70-130			1	11/17/20 10:18	11/21/20 05:44	600-05-5	
524.2 MSV	Analytical Method: EPA 524.2 Pace Analytical Services - WestVirginia									
Bromodichloromethane	**4.6**	ug/L	0.50	0.14		1		11/13/20 14:23	75-27-4	
Bromoform	ND	ug/L	0.50	0.21		1		11/13/20 14:23	75-25-2	
Chloroform	**21.8**	ug/L	0.50	0.13		1		11/13/20 14:23	67-66-3	
Dibromochloromethane	**0.36J**	ug/L	0.50	0.11		1		11/13/20 14:23	124-48-1	

REPORT OF LABORATORY ANALYSIS

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Beaver, WV 25813
(800)999-0105

ANALYTICAL RESULTS

Project: DBP STUDY-TTHM/HAA5-WV3301905
Pace Project No.: 7350147

Sample: WATER PAINT **Lab ID: 7350147002** Collected: 11/11/20 08:40 Received: 11/12/20 17:30 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
524.2 MSV		Analytical Method: EPA 524.2 Pace Analytical Services - WestVirginia								
Total Trihalomethanes (Calc.)	**26.4**	ug/L	0.50			1		11/13/20 14:23		
Surrogates										
4-Bromofluorobenzene (S)	90	%.	70-130			1		11/13/20 14:23	460-00-4	
1,2-Dichlorobenzene-d4 (S)	103	%.	70-130			1		11/13/20 14:23	2199-69-1	

Sample: TUBCAWILLA HILLS **Lab ID: 7350147003** Collected: 11/11/20 09:11 Received: 11/12/20 17:30 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
552.3 Haloacetic Acids		Analytical Method: EPA 552.3 Preparation Method: EPA 552.3 Pace Analytical Services - Ormond Beach								
Dibromoacetic Acid	ND	ug/L	1.0	0.43	60	1	11/17/20 10:18	11/21/20 06:05	631-64-1	CM
Dichloroacetic Acid	**3.1**	ug/L	1.0	0.24	60	1	11/17/20 10:18	11/21/20 06:05	79-43-6	CM
Haloacetic Acids (Total)	**13.9**	ug/L	1.0	0.90	60	1	11/17/20 10:18	11/21/20 06:05		
Monobromoacetic Acid	ND	ug/L	1.0	0.29	60	1	11/17/20 10:18	11/21/20 06:05	79-08-3	CM
Monochloroacetic Acid	**8.9**	ug/L	1.0	0.90	60	1	11/17/20 10:18	11/21/20 06:05	79-11-8	CM
Trichloroacetic Acid	**1.9**	ug/L	1.0	0.26	60	1	11/17/20 10:18	11/21/20 06:05	76-03-9	CM
Surrogates										
2,3-Dibromopropanoic Acid (S)	113	%	70-130			1	11/17/20 10:18	11/21/20 06:05	600-05-5	CM
524.2 MSV		Analytical Method: EPA 524.2 Pace Analytical Services - WestVirginia								
Bromodichloromethane	**4.3**	ug/L	0.50	0.14		1		11/13/20 14:51	75-27-4	
Bromoform	ND	ug/L	0.50	0.21		1		11/13/20 14:51	75-25-2	
Chloroform	**34.0**	ug/L	0.50	0.13		1		11/13/20 14:51	67-66-3	
Dibromochloromethane	**0.21J**	ug/L	0.50	0.11		1		11/13/20 14:51	124-48-1	
Total Trihalomethanes (Calc.)	**38.3**	ug/L	0.50			1		11/13/20 14:51		
Surrogates										
4-Bromofluorobenzene (S)	89	%.	70-130			1		11/13/20 14:51	460-00-4	
1,2-Dichlorobenzene-d4 (S)	100	%.	70-130			1		11/13/20 14:51	2199-69-1	

Sample: BOUHDRY ST **Lab ID: 7350147004** Collected: 11/11/20 09:26 Received: 11/12/20 17:30 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
552.3 Haloacetic Acids		Analytical Method: EPA 552.3 Preparation Method: EPA 552.3 Pace Analytical Services - Ormond Beach								
Dibromoacetic Acid	ND	ug/L	1.0	0.43	60	1	11/17/20 10:18	11/21/20 06:26	631-64-1	

REPORT OF LABORATORY ANALYSIS

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225 Industrial Park RD
Beaver, WV 25813
(800)999-0105

ANALYTICAL RESULTS

Project: DBP STUDY-TTHM/HAA5-WV3301905
Pace Project No.: 7350147

Sample: BOUHDRY ST **Lab ID: 7350147004** Collected: 11/11/20 09:26 Received: 11/12/20 17:30 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
552.3 Haloacetic Acids	Analytical Method: EPA 552.3 Preparation Method: EPA 552.3 Pace Analytical Services - Ormond Beach									
Dichloroacetic Acid	**10.0**	ug/L	1.0	0.24	60	1	11/17/20 10:18	11/21/20 06:26	79-43-6	
Haloacetic Acids (Total)	**26.0**	ug/L	1.0	0.90	60	1	11/17/20 10:18	11/21/20 06:26		
Monobromoacetic Acid	ND	ug/L	1.0	0.29	60	1	11/17/20 10:18	11/21/20 06:26	79-08-3	
Monochloroacetic Acid	ND	ug/L	1.0	0.90	60	1	11/17/20 10:18	11/21/20 06:26	79-11-8	
Trichloroacetic Acid	**16.0**	ug/L	1.0	0.26	60	1	11/17/20 10:18	11/21/20 06:26	76-03-9	
Surrogates										
2,3-Dibromopropanoic Acid (S)	103	%	70-130			1	11/17/20 10:18	11/21/20 06:26	600-05-5	
524.2 MSV	Analytical Method: EPA 524.2 Pace Analytical Services - WestVirginia									
Bromodichloromethane	**4.6**	ug/L	0.50	0.14		1		11/13/20 15:18	75-27-4	
Bromoform	ND	ug/L	0.50	0.21		1		11/13/20 15:18	75-25-2	
Chloroform	**25.7**	ug/L	0.50	0.13		1		11/13/20 15:18	67-66-3	
Dibromochloromethane	**0.32J**	ug/L	0.50	0.11		1		11/13/20 15:18	124-48-1	
Total Trihalomethanes (Calc.)	**30.3**	ug/L	0.50			1		11/13/20 15:18		
Surrogates										
4-Bromofluorobenzene (S)	89	%.	70-130			1		11/13/20 15:18	460-00-4	
1,2-Dichlorobenzene-d4 (S)	102	%.	70-130			1		11/13/20 15:18	2199-69-1	

Sample: MOOSE LODGE **Lab ID: 7350147005** Collected: 11/11/20 09:40 Received: 11/12/20 17:30 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
552.3 Haloacetic Acids	Analytical Method: EPA 552.3 Preparation Method: EPA 552.3 Pace Analytical Services - Ormond Beach									
Dibromoacetic Acid	ND	ug/L	1.0	0.43	60	1	11/17/20 10:18	11/21/20 06:46	631-64-1	
Dichloroacetic Acid	**2.9**	ug/L	1.0	0.24	60	1	11/17/20 10:18	11/21/20 06:46	79-43-6	
Haloacetic Acids (Total)	**10**	ug/L	1.0	0.90	60	1	11/17/20 10:18	11/21/20 06:46		
Monobromoacetic Acid	ND	ug/L	1.0	0.29	60	1	11/17/20 10:18	11/21/20 06:46	79-08-3	
Monochloroacetic Acid	ND	ug/L	1.0	0.90	60	1	11/17/20 10:18	11/21/20 06:46	79-11-8	
Trichloroacetic Acid	**7.1**	ug/L	1.0	0.26	60	1	11/17/20 10:18	11/21/20 06:46	76-03-9	
Surrogates										
2,3-Dibromopropanoic Acid (S)	106	%	70-130			1	11/17/20 10:18	11/21/20 06:46	600-05-5	
524.2 MSV	Analytical Method: EPA 524.2 Pace Analytical Services - WestVirginia									
Bromodichloromethane	**4.6**	ug/L	0.50	0.14		1		11/13/20 15:45	75-27-4	
Bromoform	ND	ug/L	0.50	0.21		1		11/13/20 15:45	75-25-2	
Chloroform	**39.2**	ug/L	0.50	0.13		1		11/13/20 15:45	67-66-3	
Dibromochloromethane	**0.22J**	ug/L	0.50	0.11		1		11/13/20 15:45	124-48-1	

REPORT OF LABORATORY ANALYSIS

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Beaver, WV 25813
(800)999-0105

ANALYTICAL RESULTS

Project: DBP STUDY-TTHM/HAA5-WV3301905
Pace Project No.: 7350147

Sample: MOOSE LODGE **Lab ID: 7350147005** Collected: 11/11/20 09:40 Received: 11/12/20 17:30 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
524.2 MSV		Analytical Method: EPA 524.2 Pace Analytical Services - WestVirginia								
Total Trihalomethanes (Calc.)	**43.8**	ug/L	0.50			1		11/13/20 15:45		
Surrogates										
4-Bromofluorobenzene (S)	90	%.	70-130			1		11/13/20 15:45	460-00-4	
1,2-Dichlorobenzene-d4 (S)	103	%.	70-130			1		11/13/20 15:45	2199-69-1	

Sample: TRIP BLANK **Lab ID: 7350147006** Collected: 11/11/20 00:00 Received: 11/12/20 17:30 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
524.2 MSV		Analytical Method: EPA 524.2 Pace Analytical Services - WestVirginia								
Bromodichloromethane	ND	ug/L	0.50	0.14		1		11/13/20 16:12	75-27-4	
Bromoform	ND	ug/L	0.50	0.21		1		11/13/20 16:12	75-25-2	
Chloroform	**0.15J**	ug/L	0.50	0.13		1		11/13/20 16:12	67-66-3	
Dibromochloromethane	ND	ug/L	0.50	0.11		1		11/13/20 16:12	124-48-1	
Total Trihalomethanes (Calc.)	ND	ug/L	0.50			1		11/13/20 16:12		
Surrogates										
4-Bromofluorobenzene (S)	94	%.	70-130			1		11/13/20 16:12	460-00-4	
1,2-Dichlorobenzene-d4 (S)	106	%.	70-130			1		11/13/20 16:12	2199-69-1	

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QUALIFIERS

Project: DBP STUDY-TTHM/HAA5-WV3301905
Pace Project No.: 7350147

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

ANALYTE QUALIFIERS

CM Results reported from secondary column due to matrix interference on the primary column.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: DBP STUDY-TTHM/HAA5-WV3301905
Pace Project No.: 7350147

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
7350147001	**HW MAIN ST.**	EPA 552.3	682335	EPA 552.3	682605
7350147002	**WATER PAINT**	EPA 552.3	682335	EPA 552.3	682605
7350147003	**TUBCAWILLA HILLS**	EPA 552.3	682335	EPA 552.3	682605
7350147004	**BOUHDRY ST**	EPA 552.3	682335	EPA 552.3	682605
7350147005	**MOOSE LODGE**	EPA 552.3	682335	EPA 552.3	682605
7350147001	**HW MAIN ST.**	EPA 524.2	49360		
7350147002	**WATER PAINT**	EPA 524.2	49360		
7350147003	**TUBCAWILLA HILLS**	EPA 524.2	49360		
7350147004	**BOUHDRY ST**	EPA 524.2	49360		
7350147005	**MOOSE LODGE**	EPA 524.2	49360		
7350147006	**TRIP BLANK**	EPA 524.2	49360		

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WO#: 7350147

7350147

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : 1 Of 1

Section A — Required Client Information:

Company:	CHARLES TOWN UTILITY BOARD
Address:	832 S. GEORGE STREET
	Charles Town, WV 25414
Email:	chutzler@ctubwv.com
Phone: (304)725-3761	Fax:
Requested Due Date:	

Section B — Required Project Information:

Report To:	Chris Hutzler
Copy To:	
Purchase Order #:	
Project Name:	DBP STUDY - TTHM/HAA5 RUSH
Project #:	

Section C — Invoice Information:

Attention:	
Company Name:	
Address:	
Pace Quote:	
Pace Project Manager:	todd.crone@pacelabs.com,
Pace Profile #:	4330

Regulatory Agency: —

State / Location: WV

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID (One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique)	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Y/N	Analyses Test: TTHM	HAA5	TTHM-HAA5	Residual Chlorine (Y/N)	
1	RAW			11/11/20	10:50	11/11/20	10:51												X	X			2 CONTAINERS
2	SLUDGE			11/11/20	10:50	11/11/20	10:51												X	X			
3	FILTERED			11/11/20	10:55	11/11/20	10:56												X	X			
4	SETTLED			11/11/20	10:30	11/11/20	10:31												X	X			2 CONTAINERS
5	NW MAIN ST			11/11/20	8:55	11/11/20	8:56												X	X	X		
6	WATER PLANT			11/11/20	8:35	11/11/20	8:40														X		
7	TUSCAWILLA HILLS			11/11/20	9:10	11/11/20	9:11														X		
8	BOUNDRY ST			11/11/20	9:25	11/11/20	9:26														X		
9	MOOSE LODGE			11/11/20	9:45	11/11/20	9:46														X		
10	TRIP BLANK																		X				
11																							
12																							approx 2C 11/11/20

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
PLEASE MAKE 3 OF THESE KITS AND SEND ON NEXT TRIP SAMPLES MUST BE RAN 2 DAY RUSH		11/12/20	12:40		11-12-20	1600
ADD 3301905 TO PROJECT		11/12/20	1640		11-12-20	1730
NAME		11/12/20	1400		11-12-20	1730
		11-12-20	1600		11-12-20	1730

SAMPLE CONDITIONS: TEMP in C: 2.1 | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: JASON CARPER

SIGNATURE of SAMPLER: | DATE Signed: 11/11/20

WO#: 7350147

PM: DTC Due Date: 11/24/20

CLIENT: CHARTWNUTWP

LIMS73 Lab Sample Condition Upon Receipt (West Vir

Pace Analytical

Client Name: _____

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☑ Pace ☐ Other: _____

Tracking #: _____

Custody Seal on Cooler/Box/Containers Present: ☐ yes ☑ no Seals intact: ☐ yes ☐ no

Thermometer Used 23 Type of Ice: (Wet) Blue None

Cooler Temperature Observed Temp 2.1 °C Correction Factor: 0.0 °C Final Temp: 2.1 °C

Comments:

pH paper Lot#	Date and Initials of person examining contents: FW 11-12-20

	Yes	No	N/A	
Chain of Custody Present:	✓			1.
Chain of Custody Filled Out:	✓			2.
Chain of Custody Relinquished:	✓			3.
Sampler Name & Signature on COC:	✓			4.
Sample Labels match COC: -Includes date/time/ID Matrix: liquid	✓			5.
Samples Arrived within Hold Time:	✓			6.
Short Hold Time Analysis (<72hr remaining):		✓		7.
Rush Turn Around Time Requested:		✓		8.
Sufficient Volume:	✓			9.
Correct Containers Used:	✓			10.
-Pace Containers Used:	✓			
Containers Intact:	✓			11.
Orthophosphate field filtered:			✓	12.
Hex Cr Aqueous sample field filtered:			✓	13.
-pH adjusted within 24 hours? (If yes, indicate acid lot #)			✓	
Filtered volume received for Dissolved tests:			✓	14.
All containers have been checked for preservation: exceptions: VOA, coliform, O&G, LLMercury, Non-aqueous matrix			✓	15.
All containers meet method preservation requirements:			✓	Initial when completed: FW Date/time samples provided to lab: 11-12-20
				Tests not preserved:
Headspace in VOA Vials:		✓		16.
Trip Blank Present:	✓			17.
Trip Blank Custody Seals Present:	✓			
				Initial when completed: FW Date: 11-12-20

Client Notification/ Resolution:

Person Contacted: _____ Date/Time: _____ Contacted By: _____

Comments/ Resolution: _____

☐ A check in this box indicates that additional information has been stored in ereports.

*PM review is documented electronically in LIMS, when the Project Manager closes the SRF Review schedule in LIMS. The status may be reviewed in the Status section of the Workorder Edit Screen.

SCUR_WV - rev.082219

WO#: 35592184

35592184

ustody

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State Of Origin: WV
Cert. Needed: [X] Yes [ ] No
Owner Received Date: 11/12/2020 Results Requested By: 11/24/2020

Workorder: 7350147 **Workorder Name:** DBP STUDY -TTHM/HAA5 RUSH

Report To	Subcontract To
Todd Crone Pace Beaver West Virginia 225 Industrial Park RD Beaver, WV 25813 Phone 800-999-0105	Pace Analytical Ormond Beach 8 East Tower Circle Ormond Beach, FL 32174 Phone (386)672-5668

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers: Other	Requested Analysis: 5522 W												LAB USE ONLY
1	HW MAIN ST.	PS	11/11/2020 08:56	7350147001	Drinking	3	X												
2	WATER PAINT	PS	11/11/2020 08:40	7350147002	Drinking	3	X												
3	TUBCAWILLA HILLS	PS	11/11/2020 09:11	7350147003	Drinking	3	X												
4	BOUHDRY ST	PS	11/11/2020 09:26	7350147004	Drinking	3	X												
5	MOOSE LODGE	PS	11/11/2020 09:40	7350147005	Drinking	3	X												

Transfers	Released By	Date/Time	Received By	Date/Time
1	Melissa Crone 11-13-2020	1458	[illegible] PACE	11/14/20 1135
2				
3				

Comments: PLEASE ADD WV3301905 TO PROJECT

Cooler Temperature on Receipt 2.6 °C | **Custody Seal** Y or (N) | **Received on Ice** (Y) or N | **Samples Intact** (Y) or N

****In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document. This chain of custody is considered complete as is since this information is available in the owner laboratory.*

Pace Analytical	Document Name: Sample Condition Upon Receipt Form	Document Revised: May 30, 2018
	Document No.: F-FL-C-007 rev. 13	Issuing Authority: Pace Florida Quality Office

Sample Condition Upon Receipt Form (SCUR)

WO#: 35592184

PM: CLG Due Date: 11/24/20

CLIENT: REICHV

Project #:

Project Manager:

Client:

Date and Initials of person:
Examining contents:
Label:
Deliver:
pH:

Thermometer Used: T33-1 Date: 11/24/20 Time: 1138 Initials: JR

State of Origin: ☐ For WV projects, all containers verified to ≤6 °C

Cooler #1 Temp.°C 2.6	(Visual) 0.	(Correction Factor) 2.6	(Actual) ☐ Samples on ice, cooling process has begun
Cooler #2 Temp.°C	(Visual)	(Correction Factor)	(Actual) ☐ Samples on ice, cooling process has begun
Cooler #3 Temp.°C	(Visual)	(Correction Factor)	(Actual) ☐ Samples on ice, cooling process has begun
Cooler #4 Temp.°C	(Visual)	(Correction Factor)	(Actual) ☐ Samples on ice, cooling process has begun
Cooler #5 Temp.°C	(Visual)	(Correction Factor)	(Actual) ☐ Samples on ice, cooling process has begun
Cooler #6 Temp.°C	(Visual)	(Correction Factor)	(Actual) ☐ Samples on ice, cooling process has begun

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ Other

Shipping Method: ☐ First Overnight ☒ Priority Overnight ☐ Standard Overnight ☐ Ground ☐ International Priority ☐ Other

Billing: ☐ Recipient ☒ Sender ☐ Third Party ☐ Credit Card ☐ Unknown

Tracking # — — 8190

Custody Seal on Cooler/Box Present: ☐ Yes ☒ No Seals Intact: ☐ Yes ☐ No Ice: (Wet) Blue Dry None

Packing Material: ☒ Bubble Wrap ☐ Bubble Bags ☐ None ☐ Other

Samples shorted to lab (If Yes, complete) Shorted Date: Shorted Time: Qty:

		Comments:
Chain of Custody Present	☒ Yes ☐ No ☐ N/A	
Chain of Custody Filled Out	☒ Yes ☐ No ☐ N/A	
Relinquished Signature & Sampler Name COC	☒ Yes ☐ No ☐ N/A	
Samples Arrived within Hold Time	☒ Yes ☐ No ☐ N/A	
Rush TAT requested on COC	☐ Yes ☒ No ☐ N/A	
Sufficient Volume	☒ Yes ☐ No ☐ N/A	
Correct Containers Used	☐ Yes ☐ No ☐ N/A	
Containers Intact	☒ Yes ☐ No ☐ N/A	
Sample Labels match COC (sample IDs & date/time of collection)	☒ Yes ☐ No ☐ N/A	
All containers needing acid/base preservation have been checked.	☐ Yes ☐ No ☒ N/A	Preservation Information: Preservative: Lot #/Trace #: Date: Time: Initials:
All Containers needing preservation are found to be in compliance with EPA recommendation: Exceptions: VOA, Coliform, TOC, O&G, Carbamates	☐ Yes ☐ No ☒ N/A	
Headspace in VOA Vials? (>6mm):	☐ Yes ☐ No ☒ N/A	
Trip Blank Present:	☐ Yes ☐ No ☒ N/A	

Client Notification/ Resolution:
Person Contacted: Date/Time:

Comments/ Resolution (use back for additional comments):

Project Manager Review: Date:

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November 25, 2020

Kristen Stolipher
CHARLES TOWN UTILITY BOARD - WATER PLANT

,

RE: Project: DBP STUDY-TTHM/HAA5 RUSH
Pace Project No.: 7350559

Dear Kristen Stolipher:

Enclosed are the analytical results for sample(s) received by the laboratory on November 17, 2020. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:
- Pace Analytical Services - Ormond Beach

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Todd Crone
todd.crone@pacelabs.com
800-999-0105
Project Manager

Enclosures

cc: JOE BURRIS, CHARLES TOWN UTILITY BOARD
Chris Hutzler, CHARLES TOWN UTILITY BOARD - WATER PLANT
LARRY STEWART, CHARLES TOWN UTILITY BOARD - WATER PLANT
Ms. Ashley Stottlemyer, CHARLES TOWN UTILITY BOARD

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CERTIFICATIONS

Project: DBP STUDY-TTHM/HAA5 RUSH
Pace Project No.: 7350559

Pace Analytical Services Ormond Beach
8 East Tower Circle, Ormond Beach, FL 32174
Alaska DEC- CS/UST/LUST
Alabama Certification #: 41320
Arizona Certification# AZ0819
Colorado Certification: FL NELAC Reciprocity
Connecticut Certification #: PH-0216
Delaware Certification: FL NELAC Reciprocity
Florida Certification #: E83079
Georgia Certification #: 955
Guam Certification: FL NELAC Reciprocity
Hawaii Certification: FL NELAC Reciprocity
Illinois Certification #: 200068
Indiana Certification: FL NELAC Reciprocity
Kansas Certification #: E-10383
Kentucky Certification #: 90050
Louisiana Certification #: FL NELAC Reciprocity
Louisiana Environmental Certificate #: 05007
Maryland Certification: #346
Michigan Certification #: 9911
Mississippi Certification: FL NELAC Reciprocity
Missouri Certification #: 236
Montana Certification #: Cert 0074
Nebraska Certification: NE-OS-28-14
New Hampshire Certification #: 2958
New Jersey Certification #: FL022
New York Certification #: 11608
North Carolina Environmental Certificate #: 667
North Carolina Certification #: 12710
North Dakota Certification #: R-216
Ohio DEP 87780
Oklahoma Certification #: D9947
Pennsylvania Certification #: 68-00547
Puerto Rico Certification #: FL01264
South Carolina Certification: #96042001
Tennessee Certification #: TN02974
Texas Certification: FL NELAC Reciprocity
US Virgin Islands Certification: FL NELAC Reciprocity
Virginia Environmental Certification #: 460165
West Virginia Certification #: 9962C
Wisconsin Certification #: 399079670
Wyoming (EPA Region 8): FL NELAC Reciprocity

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SAMPLE SUMMARY

Project: DBP STUDY-TTHM/HAA5 RUSH
Pace Project No.: 7350559

Lab ID	Sample ID	Matrix	Date Collected	Date Received
7350559001	**NW MAIN ST**	Drinking Water	11/16/20 12:00	11/17/20 17:25
7350559002	**TUSCAWILLA HILLS**	Drinking Water	11/16/20 13:00	11/17/20 17:25
7350559003	**MOOSE LODGE**	Drinking Water	11/16/20 14:00	11/17/20 17:25
7350559004	**BOUNDRY ST**	Drinking Water	11/16/20 13:30	11/17/20 17:25
7350559005	**WATER PLANT**	Drinking Water	11/16/20 12:30	11/17/20 17:25
7350559006	**TRIP BLANK**	Drinking Water	11/16/20 00:00	11/17/20 17:25

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SAMPLE ANALYTE COUNT

Project: DBP STUDY-TTHM/HAA5 RUSH
Pace Project No.: 7350559

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
7350559001	NW MAIN ST	EPA 552.3	LJM	7	PASI-O
		EPA 524.2	CMH	8	PASI-O
7350559002	TUSCAWILLA HILLS	EPA 552.3	LJM	7	PASI-O
		EPA 524.2	CMH	8	PASI-O
7350559003	MOOSE LODGE	EPA 552.3	LJM	7	PASI-O
		EPA 524.2	CMH	8	PASI-O
7350559004	BOUNDRY ST	EPA 552.3	LJM	7	PASI-O
		EPA 524.2	CMH	8	PASI-O
7350559005	WATER PLANT	EPA 552.3	LJM	7	PASI-O
		EPA 524.2	CMH	8	PASI-O
7350559006	TRIP BLANK	EPA 524.2	CMH	8	PASI-O

PASI-O = Pace Analytical Services - Ormond Beach

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ANALYTICAL RESULTS

Project: DBP STUDY-TTHM/HAA5 RUSH
Pace Project No.: 7350559

Sample: NW MAIN ST **Lab ID: 7350559001** Collected: 11/16/20 12:00 Received: 11/17/20 17:25 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
552.3 Haloacetic Acids	Analytical Method: EPA 552.3 Preparation Method: EPA 552.3 Pace Analytical Services - Ormond Beach									
Dibromoacetic Acid	ND	ug/L	1.0	0.43	60	1	11/20/20 11:35	11/24/20 02:57	631-64-1	
Dichloroacetic Acid	**9.8**	ug/L	1.0	0.24	60	1	11/20/20 11:35	11/24/20 02:57	79-43-6	
Haloacetic Acids (Total)	**28.6**	ug/L	1.0	0.90	60	1	11/20/20 11:35	11/24/20 02:57		
Monobromoacetic Acid	ND	ug/L	1.0	0.29	60	1	11/20/20 11:35	11/24/20 02:57	79-08-3	
Monochloroacetic Acid	**1.1**	ug/L	1.0	0.90	60	1	11/20/20 11:35	11/24/20 02:57	79-11-8	
Trichloroacetic Acid	**17.7**	ug/L	1.0	0.26	60	1	11/20/20 11:35	11/24/20 02:57	76-03-9	
Surrogates										
2,3-Dibromopropanoic Acid (S)	92	%	70-130			1	11/20/20 11:35	11/24/20 02:57	600-05-5	
524.2 THM	Analytical Method: EPA 524.2 Pace Analytical Services - Ormond Beach									
Bromodichloromethane	**4.9**	ug/L	1.0	0.37		1		11/20/20 11:33	75-27-4	
Bromoform	ND	ug/L	1.0	0.35		1		11/20/20 11:33	75-25-2	
Chloroform	**28.8**	ug/L	1.0	0.37		1		11/20/20 11:33	67-66-3	
Dibromochloromethane	ND	ug/L	1.0	0.47		1		11/20/20 11:33	124-48-1	
Total Trihalomethanes (Calc.)	**33.7**	ug/L	1.0	0.47	80	1		11/20/20 11:33		
Surrogates										
4-Bromofluorobenzene (S)	98	%	70-130			1		11/20/20 11:33	460-00-4	
Toluene-d8 (S)	98	%	70-130			1		11/20/20 11:33	2037-26-5	
1,2-Dichlorobenzene-d4 (S)	99	%	70-130			1		11/20/20 11:33	2199-69-1	

Sample: TUSCAWILLA HILLS **Lab ID: 7350559002** Collected: 11/16/20 13:00 Received: 11/17/20 17:25 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
552.3 Haloacetic Acids	Analytical Method: EPA 552.3 Preparation Method: EPA 552.3 Pace Analytical Services - Ormond Beach									
Dibromoacetic Acid	ND	ug/L	1.0	0.43	60	1	11/20/20 11:35	11/24/20 03:20	631-64-1	
Dichloroacetic Acid	**4.1**	ug/L	1.0	0.24	60	1	11/20/20 11:35	11/24/20 03:20	79-43-6	
Haloacetic Acids (Total)	**19.3**	ug/L	1.0	0.90	60	1	11/20/20 11:35	11/24/20 03:20		
Monobromoacetic Acid	ND	ug/L	1.0	0.29	60	1	11/20/20 11:35	11/24/20 03:20	79-08-3	
Monochloroacetic Acid	**6.8**	ug/L	1.0	0.90	60	1	11/20/20 11:35	11/24/20 03:20	79-11-8	
Trichloroacetic Acid	**8.5**	ug/L	1.0	0.26	60	1	11/20/20 11:35	11/24/20 03:20	76-03-9	
Surrogates										
2,3-Dibromopropanoic Acid (S)	105	%	70-130			1	11/20/20 11:35	11/24/20 03:20	600-05-5	
524.2 THM	Analytical Method: EPA 524.2 Pace Analytical Services - Ormond Beach									
Bromodichloromethane	**5.9**	ug/L	1.0	0.37		1		11/20/20 11:58	75-27-4	
Bromoform	ND	ug/L	1.0	0.35		1		11/20/20 11:58	75-25-2	
Chloroform	**27.7**	ug/L	1.0	0.37		1		11/20/20 11:58	67-66-3	

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ANALYTICAL RESULTS

Project: DBP STUDY-TTHM/HAA5 RUSH
Pace Project No.: 7350559

Sample: TUSCAWILLA HILLS **Lab ID: 7350559002** Collected: 11/16/20 13:00 Received: 11/17/20 17:25 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
524.2 THM		Analytical Method: EPA 524.2 Pace Analytical Services - Ormond Beach								
Dibromochloromethane	ND	ug/L	1.0	0.47		1		11/20/20 11:58	124-48-1	
Total Trihalomethanes (Calc.)	**33.6**	ug/L	1.0	0.47	80	1		11/20/20 11:58		
Surrogates										
4-Bromofluorobenzene (S)	99	%	70-130			1		11/20/20 11:58	460-00-4	
Toluene-d8 (S)	104	%	70-130			1		11/20/20 11:58	2037-26-5	
1,2-Dichlorobenzene-d4 (S)	97	%	70-130			1		11/20/20 11:58	2199-69-1	

Sample: MOOSE LODGE **Lab ID: 7350559003** Collected: 11/16/20 14:00 Received: 11/17/20 17:25 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
552.3 Haloacetic Acids		Analytical Method: EPA 552.3 Preparation Method: EPA 552.3 Pace Analytical Services - Ormond Beach								
Dibromoacetic Acid	ND	ug/L	1.0	0.43	60	1	11/20/20 11:35	11/24/20 03:43	631-64-1	
Dichloroacetic Acid	**4.2**	ug/L	1.0	0.24	60	1	11/20/20 11:35	11/24/20 03:43	79-43-6	
Haloacetic Acids (Total)	**11.2**	ug/L	1.0	0.90	60	1	11/20/20 11:35	11/24/20 03:43		
Monobromoacetic Acid	ND	ug/L	1.0	0.29	60	1	11/20/20 11:35	11/24/20 03:43	79-08-3	
Monochloroacetic Acid	ND	ug/L	1.0	0.90	60	1	11/20/20 11:35	11/24/20 03:43	79-11-8	
Trichloroacetic Acid	**6.2**	ug/L	1.0	0.26	60	1	11/20/20 11:35	11/24/20 03:43	76-03-9	
Surrogates										
2,3-Dibromopropanoic Acid (S)	98	%	70-130			1	11/20/20 11:35	11/24/20 03:43	600-05-5	
524.2 THM		Analytical Method: EPA 524.2 Pace Analytical Services - Ormond Beach								
Bromodichloromethane	**5.8**	ug/L	1.0	0.37		1		11/20/20 12:23	75-27-4	
Bromoform	ND	ug/L	1.0	0.35		1		11/20/20 12:23	75-25-2	
Chloroform	**31.1**	ug/L	1.0	0.37		1		11/20/20 12:23	67-66-3	
Dibromochloromethane	ND	ug/L	1.0	0.47		1		11/20/20 12:23	124-48-1	
Total Trihalomethanes (Calc.)	**36.9**	ug/L	1.0	0.47	80	1		11/20/20 12:23		
Surrogates										
4-Bromofluorobenzene (S)	100	%	70-130			1		11/20/20 12:23	460-00-4	
Toluene-d8 (S)	101	%	70-130			1		11/20/20 12:23	2037-26-5	
1,2-Dichlorobenzene-d4 (S)	99	%	70-130			1		11/20/20 12:23	2199-69-1	

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ANALYTICAL RESULTS

Project: DBP STUDY-TTHM/HAA5 RUSH
Pace Project No.: 7350559

Sample: BOUNDRY ST **Lab ID: 7350559004** Collected: 11/16/20 13:30 Received: 11/17/20 17:25 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
552.3 Haloacetic Acids	Analytical Method: EPA 552.3 Preparation Method: EPA 552.3 Pace Analytical Services - Ormond Beach									
Dibromoacetic Acid	ND	ug/L	1.0	0.43	60	1	11/20/20 11:35	11/24/20 04:06	631-64-1	
Dichloroacetic Acid	**12.4**	ug/L	1.0	0.24	60	1	11/20/20 11:35	11/24/20 04:06	79-43-6	
Haloacetic Acids (Total)	**38.9**	ug/L	1.0	0.90	60	1	11/20/20 11:35	11/24/20 04:06		
Monobromoacetic Acid	ND	ug/L	1.0	0.29	60	1	11/20/20 11:35	11/24/20 04:06	79-08-3	
Monochloroacetic Acid	**1.9**	ug/L	1.0	0.90	60	1	11/20/20 11:35	11/24/20 04:06	79-11-8	
Trichloroacetic Acid	**24.6**	ug/L	1.0	0.26	60	1	11/20/20 11:35	11/24/20 04:06	76-03-9	
Surrogates										
2,3-Dibromopropanoic Acid (S)	103	%	70-130			1	11/20/20 11:35	11/24/20 04:06	600-05-5	
524.2 THM	Analytical Method: EPA 524.2 Pace Analytical Services - Ormond Beach									
Bromodichloromethane	**5.4**	ug/L	1.0	0.37		1		11/20/20 12:48	75-27-4	
Bromoform	ND	ug/L	1.0	0.35		1		11/20/20 12:48	75-25-2	
Chloroform	**38.0**	ug/L	1.0	0.37		1		11/20/20 12:48	67-66-3	
Dibromochloromethane	ND	ug/L	1.0	0.47		1		11/20/20 12:48	124-48-1	
Total Trihalomethanes (Calc.)	**43.3**	ug/L	1.0	0.47	80	1		11/20/20 12:48		
Surrogates										
4-Bromofluorobenzene (S)	97	%	70-130			1		11/20/20 12:48	460-00-4	
Toluene-d8 (S)	106	%	70-130			1		11/20/20 12:48	2037-26-5	
1,2-Dichlorobenzene-d4 (S)	97	%	70-130			1		11/20/20 12:48	2199-69-1	

Sample: WATER PLANT **Lab ID: 7350559005** Collected: 11/16/20 12:30 Received: 11/17/20 17:25 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
552.3 Haloacetic Acids	Analytical Method: EPA 552.3 Preparation Method: EPA 552.3 Pace Analytical Services - Ormond Beach									
Dibromoacetic Acid	ND	ug/L	1.0	0.43	60	1	11/20/20 11:35	11/24/20 04:29	631-64-1	
Dichloroacetic Acid	**21.1**	ug/L	1.0	0.24	60	1	11/20/20 11:35	11/24/20 04:29	79-43-6	
Haloacetic Acids (Total)	**50.6**	ug/L	1.0	0.90	60	1	11/20/20 11:35	11/24/20 04:29		
Monobromoacetic Acid	ND	ug/L	1.0	0.29	60	1	11/20/20 11:35	11/24/20 04:29	79-08-3	
Monochloroacetic Acid	**1.8**	ug/L	1.0	0.90	60	1	11/20/20 11:35	11/24/20 04:29	79-11-8	
Trichloroacetic Acid	**27.7**	ug/L	1.0	0.26	60	1	11/20/20 11:35	11/24/20 04:29	76-03-9	
Surrogates										
2,3-Dibromopropanoic Acid (S)	102	%	70-130			1	11/20/20 11:35	11/24/20 04:29	600-05-5	
524.2 THM	Analytical Method: EPA 524.2 Pace Analytical Services - Ormond Beach									
Bromodichloromethane	**3.2**	ug/L	1.0	0.37		1		11/20/20 13:13	75-27-4	
Bromoform	ND	ug/L	1.0	0.35		1		11/20/20 13:13	75-25-2	
Chloroform	**28.2**	ug/L	1.0	0.37		1		11/20/20 13:13	67-66-3	

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ANALYTICAL RESULTS

Project: DBP STUDY-TTHM/HAA5 RUSH
Pace Project No.: 7350559

Sample: WATER PLANT **Lab ID: 7350559005** Collected: 11/16/20 12:30 Received: 11/17/20 17:25 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
524.2 THM		Analytical Method: EPA 524.2								
		Pace Analytical Services - Ormond Beach								
Dibromochloromethane	ND	ug/L	1.0	0.47		1		11/20/20 13:13	124-48-1	
Total Trihalomethanes (Calc.)	**31.4**	ug/L	1.0	0.47	80	1		11/20/20 13:13		
Surrogates										
4-Bromofluorobenzene (S)	98	%	70-130			1		11/20/20 13:13	460-00-4	
Toluene-d8 (S)	102	%	70-130			1		11/20/20 13:13	2037-26-5	
1,2-Dichlorobenzene-d4 (S)	97	%	70-130			1		11/20/20 13:13	2199-69-1	

Sample: TRIP BLANK **Lab ID: 7350559006** Collected: 11/16/20 00:00 Received: 11/17/20 17:25 Matrix: Drinking Water

Parameters	Results	Units	Report Limit	MDL	Reg. Limit	DF	Prepared	Analyzed	CAS No.	Qual
524.2 THM		Analytical Method: EPA 524.2								
		Pace Analytical Services - Ormond Beach								
Bromodichloromethane	ND	ug/L	1.0	0.37		1		11/20/20 13:37	75-27-4	
Bromoform	ND	ug/L	1.0	0.35		1		11/20/20 13:37	75-25-2	
Chloroform	ND	ug/L	1.0	0.37		1		11/20/20 13:37	67-66-3	
Dibromochloromethane	ND	ug/L	1.0	0.47		1		11/20/20 13:37	124-48-1	
Total Trihalomethanes (Calc.)	ND	ug/L	1.0	0.47	80	1		11/20/20 13:37		
Surrogates										
4-Bromofluorobenzene (S)	110	%	70-130			1		11/20/20 13:37	460-00-4	
Toluene-d8 (S)	103	%	70-130			1		11/20/20 13:37	2037-26-5	
1,2-Dichlorobenzene-d4 (S)	97	%	70-130			1		11/20/20 13:37	2199-69-1	

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QUALIFIERS

Project: DBP STUDY-TTHM/HAA5 RUSH
Pace Project No.: 7350559

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: DBP STUDY-TTHM/HAA5 RUSH
Pace Project No.: 7350559

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
7350559001	NW MAIN ST	EPA 552.3	683590	EPA 552.3	684381
7350559002	TUSCAWILLA HILLS	EPA 552.3	683590	EPA 552.3	684381
7350559003	MOOSE LODGE	EPA 552.3	683590	EPA 552.3	684381
7350559004	BOUNDRY ST	EPA 552.3	683590	EPA 552.3	684381
7350559005	WATER PLANT	EPA 552.3	683590	EPA 552.3	684381
7350559001	NW MAIN ST	EPA 524.2	683568		
7350559002	TUSCAWILLA HILLS	EPA 524.2	683568		
7350559003	MOOSE LODGE	EPA 524.2	683568		
7350559004	BOUNDRY ST	EPA 524.2	683568		
7350559005	WATER PLANT	EPA 524.2	683568		
7350559006	TRIP BLANK	EPA 524.2	683568		

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WO# : 7350559

7350559

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CHAIN-OF-CUSTODY / Analytical Request F

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields m

Page : 1 Of 1

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	CHARLES TOWN UTILITY BOARD	Report To:	Chris Hutzler	Attention:	
Address:	832 S. GEORGE STREET	Copy To:		Company Name:	
	Charles Town, WV 25414			Address:	
Email:	chutzler@ctubwv.com	Purchase Order #:		Pace Quote:	
Phone:	(304)725-3761 Fax:	Project Name:	DBP STUDY - TTHM/HAA5 RUSH	Pace Project Manager:	todd.crone@pacelabs.com,
Requested Due Date:		Project #:		Pace Profile #:	4330

Regulatory Agency
State / Location
WV

ITEM #	SAMPLE ID One Character per box. (A-Z, 0-9 / , -) Sample ids must be unique MATRIX: Drinking Water DW, Water WT, Waste Water WW, Product P, Soil/Solid SL, Oil OL, Wipe WP, Air AR, Other OT, Tissue TS	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Requested Analysis Filtered (Y/N) Y/N	Analyses Test: TTHM	HAA5	Residual Chlorine (Y/N)
1	NW Main St			11-16-20	1200	11-16-20	1200											X	X	
2	Tuscawilla Hills			11-16-20	1300	11-16-20	1300											X	X	
3	Moose Lodge			11-16-20	1400	11-16-20	1400											X	X	
4	Boundry St			11-16-20	1330	11-16-20	1330											X	X	
5	Water Plant			11-16-20	1230	11-16-20	1230											X	X	
6																				
7																				
8																				
9																				
10																				
11																				
12																				

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
PLEASE MAKE 3 OF THESE KITS AND SEND ON NEXT TRIP SAMPLES MUST BE RAN 2 DAY RUSH		11-16-20	1700		11-16-20		
		11-17-20	1000		11-17-20	1400	
		11-16-20			11-17-20	1330	
		11-17-20	1600		11-17-20	1725	

SAMPLER NAME AND SIGNATURE			TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
PRINT Name of SAMPLER:	Chris Hutzler					
SIGNATURE of SAMPLER:		DATE Signed: 11-16-20				

11-17-20 1725

WO#: 7350559

PM: DTC Due Date: 12/01/20

CLIENT: CHARTWNUTWP

LIMS73 Lab Sample Condition Upon Receipt (West

Pace Analytical

Client Name: _____

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☑ Pace ☐ Other: _____

Tracking #: _____

Custody Seal on Cooler/Box/Containers Present: ☐ yes ☑ no Seals intact: ☐ yes ☐ no

Thermometer Used 23 Type of Ice: (Wet) Blue None

Cooler Temperature Observed Temp 1.7 °C Correction Factor: 0.0 °C Final Temp: 1.7 °C

Comments:

pH paper Lot#	Date and Initials of person examining contents: FW 11-17-20

	Yes	No	N/A	
Chain of Custody Present:	✓			1.
Chain of Custody Filled Out:	✓			2.
Chain of Custody Relinquished:	✓			3.
Sampler Name & Signature on COC:	✓			4.
Sample Labels match COC: -Includes date/time/ID Matrix: Liquid	✓			5.
Samples Arrived within Hold Time:	✓			6.
Short Hold Time Analysis (<72hr remaining):		✓		7.
Rush Turn Around Time Requested:		✓		8.
Sufficient Volume:	✓			9.
Correct Containers Used:	✓			10.
-Pace Containers Used:	✓			
Containers Intact:	✓			11.
Orthophosphate field filtered:			✓	12.
Hex Cr Aqueous sample field filtered:			✓	13.
-pH adjusted within 24 hours? (If yes, indicate acid lot #)			✓	
Filtered volume received for Dissolved tests:			✓	14.
All containers have been checked for preservation: exceptions: VOA, coliform, O&G, LLMercury, Non-aqueous matrix			✓	15.
All containers meet method preservation requirements:			✓	Initial when completed: FW Date/time samples provided to lab: 11-17-20
				Tests not preserved:
Headspace in VOA Vials:		✓		16.
Trip Blank Present:	✓			17.
Trip Blank Custody Seals Present:	✓			
				Initial when completed: FW Date: 11-17-20

Client Notification/ Resolution:

Person Contacted: _____ Date/Time: _____ Contacted By: _____

Comments/ Resolution: _____

☐ A check in this box indicates that additional information has been stored in ereports.

*PM review is documented electronically in LIMS, when the Project Manager closes the SRF Review schedule in LIMS. The status may be reviewed in the Status section of the Workorder Edit Screen.

Internal Transfer Chain of Custody

Pace Analytical®
www.pacelabs.com

☐ Samples Pre-Logged into eCOC.

State Of Origin: WV
Cert. Needed: ☒ Yes ☐ No
Owner Received Date: 11/17/2020 **Results Requested By:** 12/1/2020

Workorder: 7350559 **Workorder Name:** DBP STUDY-TTHM/HAA5 RUSH

WO# : 35593481

35593481

Report To	Subcontract To
Todd Crone Pace Beaver West Virginia 225 Industrial Park RD Beaver, WV 25813 Phone 800-999-0105	Pace Analytical Ormond Beach 8 East Tower Circle Ormond Beach, FL 32174 Phone (386)672-5668

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers: HCL	Other	Ascorbic				5242 W - TTHM - TRIP BLANK	5242 W - TTHM	5522 W - HAA5										LAB USE ONLY
1	NW MAIN ST	PS	11/16/2020 12:00	7350559001	Drinking		3	3					X	X										
2	TUSCAWILLA HILLS	PS	11/16/2020 13:00	7350559002	Drinking		3	3					X	X										
3	MOOSE LODGE	PS	11/16/2020 14:00	7350559003	Drinking		3	3					X	X										
4	BOUNDRY ST	PS	11/16/2020 13:30	7350559004	Drinking		3	3					X	X										
5	WATER PLANT	PS	11/16/2020 12:30	7350559005	Drinking		3	3					X	X										
6	TRIP BLANK	PS	11/16/2020 00:00	7350559006	Drinking	1	[illegible]	[illegible]				X												

Transfers	Released By	Date/Time	Received By	Date/Time
1	[illegible] 11-18-2020	1123	[illegible]	11/19/20 11:20
2				
3				

Comments

PACE ORMOND, PLEASE MAKE SURE SAMPLES ARE LOADED AND RAN 24-48 HOURS OF RECEIPT.
FINAL REPORT DOES NOT HAVE TO BE DONE BUT SAMPLES NEED LOADED ASAP PLEASE.

Cooler Temperature on Receipt 1 °C | Custody Seal Y or N | Received on Ice Y or N | Samples Intact Y or N

****In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document. This chain of custody is considered complete as is since this information is available in the owner laboratory.*

Pace Analytical	Document Name: Sample Condition Upon Receipt Form	Document Revised: May 30, 2018
	Document No.: F-FL-C-007 rev. 13	Issuing Authority: Pace Florida Quality Office

WO#: 35593481 (SCUR)

Project #
Project Manager: PM: CLG **Due Date: 12/02/20**
Client: CLIENT: REICHV

Date and Initials of person:
Examining contents: SPV
Label:
Deliver:
pH:

Thermometer Used: T-337 Date: 11-19-20 Time: 11:14 Initials: CEJ

State of Origin: ☐ For WV projects, all containers verified to ≤6 °C

Cooler #1 Temp.°C	6.1 (Visual)	.0 (Correction Factor)	6.1 (Actual)	☐ Samples on ice, cooling process has begun
Cooler #2 Temp.°C	(Visual)	(Correction Factor)	(Actual)	☐ Samples on ice, cooling process has begun
Cooler #3 Temp.°C	(Visual)	(Correction Factor)	(Actual)	☐ Samples on ice, cooling process has begun
Cooler #4 Temp.°C	(Visual)	(Correction Factor)	(Actual)	☐ Samples on ice, cooling process has begun
Cooler #5 Temp.°C	(Visual)	(Correction Factor)	(Actual)	☐ Samples on ice, cooling process has begun
Cooler #6 Temp.°C	(Visual)	(Correction Factor)	(Actual)	☐ Samples on ice, cooling process has begun

Courier: ☑ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ Other

Shipping Method: ☐ First Overnight ☐ Priority Overnight ☑ Standard Overnight ☐ Ground ☐ International Priority ☐ Other

Billing: ☐ Recipient ☐ Sender ☐ Third Party ☐ Credit Card ☐ Unknown

Tracking # 7721 2413 7450

Custody Seal on Cooler/Box Present: ☐ Yes ☑ No **Seals intact:** ☐ Yes ☐ No **Ice:** (Wet) Blue Dry None

Packing Material: ☐ Bubble Wrap ☑ Bubble Bags ☐ None ☐ Other

Samples shorted to lab (If Yes, complete) Shorted Date: Shorted Time: Qty:

		Comments:
Chain of Custody Present	☑Yes ☐No ☐N/A	
Chain of Custody Filled Out	☑Yes ☐No ☐N/A	
Relinquished Signature & Sampler Name COC	☑Yes ☐No ☐N/A	
Samples Arrived within Hold Time	☑Yes ☐No ☐N/A	
Rush TAT requested on COC	☐Yes ☑No ☐N/A	
Sufficient Volume	☑Yes ☐No ☐N/A	
Correct Containers Used	☑Yes ☐No ☐N/A	
Containers Intact	☑Yes ☐No ☐N/A	
Sample Labels match COC (sample IDs & date/time of collection)	☑Yes ☐No ☐N/A	
All containers needing acid/base preservation have been checked.	☐Yes ☐No ☑N/A	Preservation Information:
All Containers needing preservation are found to be in compliance with EPA recommendation: Exceptions: VOA, Coliform, TOC, O&G, Carbamates	☐Yes ☐No ☑N/A	Preservative: Lot #/Trace #: Date: Time: Initials:
Headspace in VOA Vials? (>6mm):	☐Yes ☑No ☐N/A	
Trip Blank Present:	☑Yes ☐No ☐N/A	

Client Notification/ Resolution:
Person Contacted: Date/Time:

Comments/ Resolution (use back for additional comments):

Project Manager Review: Date:

2013-2019
CONSUMER CONFIDENCE REPORTS

2019 Test Results - Charles Town Utility Board

PWS ID #WV3301905

The **Charles Town Utility Board** routinely monitors for contaminants in your drinking water according to federal and state laws. The tables below show the results of our monitoring for contaminants.

Regulated Contaminants

Microbiological Contaminants

Contaminant	Violation Y/N	Level Detected	Unit of Measure	MCLG	MCL	Likely Source of Contamination
Coliform (TCR)	N	No detected results were found in the calendar year of 2019	ppm	0	Systems that Collect Less Than 40 Samples per Month - No more than 1 positive monthly sample	Naturally present in the environment

Inorganic Contaminants

Contaminant	Violation Y/N	Level Detected	Unit of Measure	MCLG	MCL	Likely Source of Contamination
Barium [1]	N	0.0268	ppm	2	2	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Fluoride [1]	N	0.56	ppm	4	4	Erosion of natural deposits; water additive that promotes strong teeth; discharge from aluminum and fertilizer plants
Nitrate [1]	N	1.77 (Range 0.97 - 1.77)	ppm	10	10	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits
Nitrate-Nitrite [2]	N	1.31	ppm	10	10	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits
Nitrite [2]	N	0.34	ppm	1	1	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits

Disinfection Byproducts

Contaminant	Violation Y/N	Monitoring Period	Highest RAA	Range	Unit of Measure	MCLG	MCL	Likely Source of Contamination
Haloacetic Acids (HAA5)	Y	2019	84	21.2 - 106	ppb	NA	60	By-product of drinking water disinfection
Total Trihalomethanes (TTHMs)	Y	2019	218	11.2 - 218	ppb	NA	80	By-product of drinking water chlorination
Chlorine / Chloramines	N	01/01/2019 - 12/31/2019	1.9	NA	ppm	4	4	Water additive used to control microbes

Total Organic Carbon

Collection Date	Required Removal Ratio	Highest Value / Range	MCLG	MCL	Likely Source of Contamination
11/1/2019	1 RATIO	2.7 / 0.79 - 2.7	NA	TT	Naturally present in the environment

Copper and Lead

Contaminant	Monitoring Period	90th Percentile	Range	Unit of Measure	AL	Sites Over AL	Likely Source of Contamination
Copper, Free	2019	0.082	0.00001 - 0.44	ppm	1.3	0	Corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives
Lead	2019	1.6	0 - 19	ppb	15	1	Corrosion of household plumbing systems; erosion of natural deposits

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. Your water system is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.

Turbidity

Contaminant	Violation Y/N	Monitoring Period	Highest Value	Unit of Measure	TT Requirement	Likely Source
Turbidity	N	06/2019	0.29	NTU	In any month, at least 95% of the samples must be less than 0.3 NTU	Soil Runoff

Radiological Contaminants No Detected Results were Found in the Calendar Year of 2019
All other water test results for the reporting year 2019 were non-detectable.

Water Quality Data Table

Definitions of terms and abbreviations used in the table or report:

- **MCLG -** Maximum Contaminant Level Goal, or the level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

2018 Test Results - Charles Town Utility Board

PWS ID #WV3301905

The **Charles Town Utility Board** routinely monitors for contaminants in your drinking water according to federal and state laws. The tables below show the results of our monitoring for contaminants.

Regulated Contaminants

Microbiological Contaminants

Contaminant	Violation Y/N	Level Detected	Unit of Measure	MCLG	MCL	Likely Source of Contamination
Coliform (TCR)	N	In the month of December, 1 sample(s) returned as positive	ppm	0	Systems that Collect Less Than 40 Samples per Month - No more than 1 positive monthly sample	Naturally present in the environment

Inorganic Contaminants

Contaminant	Violation Y/N	Level Detected	Unit of Measure	MCLG	MCL	Likely Source of Contamination
Barium [1]	N	0.0286	ppm	2	2	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Fluoride [1]	N	0.53	ppm	4	4	Erosion of natural deposits; water additive that promotes strong teeth; discharge from aluminum and fertilizer plants
Nitrate [1]	N	0.86	ppm	10	10	Runoff from fertilizer use; erosion of natural deposits

Disinfection Byproducts

Contaminant	Violation Y/N	Monitoring Period	Highest RAA	Range	Unit of Measure	MCLG	MCL	Likely Source of Contamination
Haloacetic Acids (HAAC5)	N	2018	53	16.2 - 97	ppb	NA	60	By-product of drinking water disinfection
Total Trihalomethanes (TTHMs)	N	2018	42	11.8 - 64	ppb	NA	80	By-product of drinking water chlorination

Total Organic Carbon

Lowest Month for Removal	Required Removal Ratio	Lowest Monthly Removal Ratio	MCLG	MCL	Likely Source of Contamination
1/1/2018 - 3/31/2018	1 RATIO	1.11	NA	TT	Naturally present in the environment

Copper and Lead

Contaminant	Monitoring Period	90th Percentile	Range	Unit of Measure	AL	Sites Over AL	Likely Source of Contamination
Copper, Free	2018	0.223	0.0011 - 1.26	ppm	1.3	1.3	Corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives
Lead	2018	5.3	0.2 - 285*	ppb	15	1	Corrosion of household plumbing systems; erosion of natural deposits

* *The sample that was reported with a 285 ppb result was determined to be taken incorrectly by the customer. A follow up sample was immediately taken that resulted in a level well below the published MCL. All other samples collected also resulted in levels less than the MCL. The CCR shows this incorrect result with this explanation in order to be completely transparent with our customers.*

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. Your water system is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.

The **Charles Town Utility Board** routinely monitors for contaminants in your drinking water according to federal and state laws. The tables below show the results of our monitoring for contaminants.

Table of Test Results - Regulated Contaminants - Charles Town Utility Board

Contaminant	Violation Y/N	Level Detected	Unit of Measure	MCLG	MCL	Likely Source of Contamination
Regulated Contaminants						
Microbiological Contaminants						
Turbidity[1]	N	0.08 100% of monthly samples <0.3	NTU	0	TT	Soil runoff
Total Organic Carbon	N	1.64	ppm	NA	TT	Naturally present in the environment
Inorganic Contaminants						
Barium	N	0.032	ppm	2	2	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Chromium	N	1.4	ppb	100	100	Discharge from steel and pulp mills; erosion of natural deposits.
Copper*	N	0.872	ppb	1.3	AL = 1.3	Corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives
Fluoride	N	0.83	ppm	4	4	Erosion of natural deposits; water additive that promotes strong teeth; discharge from aluminum and fertilizer plants
Lead*	N	6.9	ppb	0	AL = 15	Corrosion of household plumbing systems; erosion of natural deposits
Nitrate	N	1.23	ppm	10	10	Runoff from fertilizer use; erosion of natural deposits
Volatile Organic Contaminants						
		200 N. West St. / Tuscawilla Plaza / Boundary St. / Moose Lodge				
Haloacetic Acids (HAAC5)	N	42.82 Annual Avg. / Range 18.8-56.3 ; 25.20 Annual Avg. / Range 11.4-58 ; 41.45 Annual Avg. / Range 18.4-54.4 ; 32.75 Annual Avg. / Range 20.7-50.5	ppb	NA	60	By-product of drinking water disinfection
Total Trihalomethanes (TTHMs)	N	32.8 Annual Avg. / Range 12.5-49.3 ; 36.72 Annual Avg. / Range 18.3-56.6 ; 41.95 Annual Avg. / Range 15-56.5 ; 39.30 Annual Avg. / Range 20.6-58.6	ppb	NA	80	By-product of drinking water chlorination

The Charles Town Utility Board routinely monitors for contaminants in your drinking water according to federal and state laws. The tables below show the results of our monitoring for contaminants.

Table of Test Results - Regulated Contaminants - Charles Town Utility Board

Regulated Contaminants

Contaminant	Violation Y/N	Level Detected	Unit of Measure	MCLG	MCL	Likely Source of Contamination
Microbiological Contaminants						
Turbidity[1]	N	0.10 100% of monthly samples <0.3	NTU	0	TT	Soil runoff
Total Organic Carbon	N	1.43	ppm	NA	TT	Naturally present in the environment
Inorganic Contaminants						
Barium	N	0.029	ppm	2	2	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Copper*	N	0.618	ppb	1.3	AL = 1.3	Corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives
Fluoride	N	0.67	ppm	4	4	Erosion of natural deposits; water additive that promotes strong teeth; discharge from aluminum and fertilizer plants
Lead*	N	18	ppb	0	AL = 15	Corrosion of household plumbing systems; erosion of natural deposits
Nitrate	N	1.03	ppm	10	10	Runoff from fertilizer use; erosion of natural deposits
Volatile Organic Contaminants						

		200 N. West St.	Tuscawilla Plaza	Boundary St.	Moose Lodge				
Haloacetic Acids (HAAC5)	N	23.5 Annual Avg. Range 18.8-56.3	3.5 Annual Avg. Range 11.4-58	24.8 Annual Avg. Range 18.4-54.4	19.5 Annual Avg. Range 20.7-50.5	ppb	NA	60	By-product of drinking water disinfection
Total Trihalomethanes (TTHMs)	N	18.4 Annual Avg. Range 12.5-49.3	25.0 Annual Avg. Range 18.3-56.6	24.7 Annual Avg. Range 15-56.5	26.3 Annual Avg. Range 20.6-58.6	ppb	NA	80	By-product of drinking water chlorination

Unregulated Contaminants

Contaminant	Violation Y/N	Level Detected	Unit of Measure	MCLG	MCL	Likely Source of Contamination
Sodium	N	8.05	ppm	NE	20	Erosion of natural deposits
Sulfate	N	13.0	ppm	N/A	N/A	Runoff/leaching from natural deposits; industrial waste

The Charles Town Utility Board routinely monitors for contaminants in your drinking water according to federal and state laws. The tables below show the results of our monitoring for contaminants.

Table of Test Results - Regulated Contaminants - Charles Town Utility Board

Regulated Contaminants

Contaminant	Violation Y/N	Level Detected	Unit of Measure	MCLG	MCL	Likely Source of Contamination
Microbiological Contaminants						
Turbidity[1]	N	0.10 100% of monthly samples <0.3	NTU	0	TT	Soil runoff
Total Organic Carbon	N	0.2	ppm	NA	TT	Naturally present in the environment
Inorganic Contaminants						
Barium	N	0.031	ppm	2	2	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Fluoride	N	0.44	ppm	4	4	Erosion of natural deposits; water additive that promotes strong teeth; discharge from aluminum and fertilizer plants
Nitrate	N	1.36	ppm	10	10	Runoff from fertilizer use; erosion of natural deposits
Volatile Organic Contaminants						
		200 N. West St. / Tuscawilla Plaza / Boundry St. / Moose Lodge				
Haloacetic Acids (HAAC5)	N	35.9 Annual Avg. / Range 18.8-56.3 — 33.2 Annual Avg. / Range 11.4-58 — 28.7 Annual Avg. / Range 18.4-54.4 — 38.6 Annual Avg. / Range 20.7-50.5	ppb	NA	60	By-product of drinking water disinfection
Total Trihalomethanes (TTHMs)	N	30.1 Annual Avg. / Range 12.5-49.3 — 40.4 Annual Avg. / Range 18.3-56.6 — 37.9 Annual Avg. / Range 15-56.5 — 37.7 Annual Avg. / Range 20.6-58.6	ppb	NA	80	By-product of drinking water chlorination

Unregulated Contaminants

Contaminant	Violation Y/N	Level Detected	Unit of Measure	MCLG	MCL	Likely Source of Contamination
Sodium*	N	11.5	ppm	NE	20	Erosion of natural deposits

Regulated Disinfectants

Contaminant	Violation Y/N	Level Detected	Unit of Measure	MCLG	MCL	Likely Source of Contamination
Chlorine	N	3.01 (Range 0.2-3.4)	ppm	4	4	Water additive used to control microbes

1. Turbidity is a measure of the cloudiness in drinking water. Turbidity is monitored because it is a good indicator of the effectiveness of our filtration system.

2014 Test Results

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline (800-426-4791).

The Charles Town Utility Board routinely monitors for contaminants in your drinking water according to federal and state laws. The tables below show the results of our monitoring for contaminants.

Regulated Contaminants

Contaminant	Violation Y/N	Level Detected	Unit of Measure	MCLG	MCL	Likely Source of Contamination
Microbiological Contaminants						
Turbidity[1]	N	0.10 100% of monthly samples <0.3	NTU	0	TT	Soil runoff
Total Organic Carbon	N	0.04	ppm	NA	TT	Naturally present in the environment
Inorganic Contaminants						
Barium	N	0.02	ppm	2	2	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Fluoride	N	0.40	ppm	4	4	Erosion of natural deposits; water additive that promotes strong teeth; discharge from aluminum and fertilizer plants
Nitrate	N	1.61	ppm	10	10	Runoff from fertilizer use; erosion of natural deposits
Chlorine	N	2.97 (Range: 0.2-3.4)	ppm	4	4	Water additive used to control microbes
Volatile Organic Contaminants						

		200 N. West St.	Tuscawilla Plaza	Boundry St.	Moose Lodge				
Haloacetic Acids (HAA5)	N	26.41 Annual Avg. Range 16.65-38.73	29.34 Annual Avg. Range 16.65-38.73	30.72 Annual Avg. Range 16.65-38.73	29.85 Annual Avg. Range 16.65-38.73	ppb	NA	60	By-product of drinking water disinfection
Total Trihalomethanes (TTHM)	N	29.57 Annual Avg. Range 18.92-60.26	29.65 Annual Avg. Range 18.92-60.26	27.50 Annual Avg. Range 0.2-3.4	28.58 Annual Avg. Range 18.92-60.26	ppb	NA	80	By-product of drinking water chlorination

Unregulated Contaminants

Contaminant	Violation Y/N	Level Detected	Unit of Measure	MCLG	MCL	Likely Source of Contamination
Sodium*	N	9.02	ppm	NE	20	Erosion of natural deposits

1. Turbidity is a measure of the cloudiness in drinking water. Turbidity is monitored because it is a good indicator of the effectiveness of our filtration system.

Monitoring Violation

All other water test results for the reporting year 2014 were all non-detectable. The Charles Town Water Department was issued a monitoring violation in 2014, information concerning this violation is contained within this mailing. The utility failed to take a required sample for volatile organic chemicals during the required sampling period. This sampling violation has been rectified as of this time and results have been submitted as required. It is important to note that this was a monitoring violation only, at no time were the maximum contaminant levels exceeded.

2013 Test Results

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline (800-426-4791).

The Charles Town Utility Board routinely monitors for contaminants in your drinking water according to federal and state laws. The tables below show the results of our monitoring for contaminants.

Regulated Contaminants

Contaminant	Violation Y/N	Level Detected	Unit of Measure	MCLG	MCL	Likely Source of Contamination
Microbiological Contaminants						
Turbidity[1]	N	0.29 100% of monthly samples <0.3	NTU	0	TT	Soil runoff
Total Organic Carbon	N	0.04	ppm	NA	TT	Naturally present in the environment
Inorganic Contaminants						
Barium	N	0.032	ppm	2	2	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Fluoride	N	0.74	ppm	4	4	Erosion of natural deposits; water additive that promotes strong teeth; discharge from aluminum and fertilizer plants
Nitrate	N	1.72	ppm	10	10	Runoff from fertilizer use; erosion of natural deposits
Volatile Organic Contaminants						
Chlorine	N	2.02 Annual Avg. Range 0.2-3.4	ppm	4	4	Water additive used to control microbes
Haloacetic Acids (HAA5)	N	27.57 Annual Avg. Range 16.65-38.73	ppb	NA	60	By-product of drinking water disinfection
Total Trihalomethanes (TTHM)	N	27.19 Annual Avg. Range 18.92-60.26	ppb	NA	80	By-product of drinking water chlorination

APPENDIX C

EPA DISINFECTANTS AND DISINFECTION BYPRODUCTS RULES

(STAGE 1 AND STAGE 2)



Disinfectants and Disinfection Byproducts Rules

(Stage 1 and Stage 2)

What Do They Mean to You?

Office of Water (4606M)
EPA 815-R-20-005
June 2020

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Definitions and Acronyms

Definitions

Combined distribution system (CDS) – the interconnected distribution system consisting of the distribution systems of wholesale systems and of the consecutive systems that receive some or all of their finished water from those wholesale systems.

Consecutive system – a public water system (PWS) that receives some or all of its finished water from one or more wholesale systems. Delivery may be through a direct connection or through the distribution system of one or more consecutive systems.

Dual sample set – a set of two samples collected at the same time and same location, with one sample analyzed for total trihalomethanes (TTHM) and the other analyzed for five haloacetic acids (HAA5).

Enhanced coagulation – the addition of sufficient coagulant for improved removal of disinfection byproduct precursors by conventional filtration treatment.

Enhanced softening – the removal of disinfection byproduct precursors by precipitative softening.

Locational running annual average (LRAA) – the average of analytical results for samples taken at a particular monitoring location during the previous four calendar quarters.

Log – Logarithm (common, base 10).

Log inactivation – Logarithm of (N0/NT).

Maximum contaminant level (MCL) – the highest level of a contaminant that is allowed in drinking water. MCLs are set as close to maximum contaminant level goals (MCLGs) as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.

Maximum contaminant level goal (MCLG) – the level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals.

Maximum residual disinfectant level (MRDL) – the maximum level of a disinfectant added for water treatment that may not be exceeded without an unacceptable possibility of adverse health effects. MRDLs are enforceable standards analogous to MCLs.

Maximum residual disinfectant level goal (MRDLG) – the maximum level of a disinfectant added for water treatment at which no known or anticipated health effects occur, and which allows an adequate margin of safety. MRDLGs are nonenforceable health goals and do not reflect the benefit of the addition of the disinfectant for control of waterborne microbial contaminants.

Running annual average (RAA) – the average of all sample analytical results taken during the previous four calendar quarters.

Specific Ultraviolet Absorption (SUVA) – Specific Ultraviolet Absorption at 254 nanometers (nm) is an indicator of the humic content of water. It is a calculated parameter obtained by dividing a sample's ultraviolet absorption at a wavelength of 254 nm (UV 254) (in m^{-1}) by its concentration of dissolved organic carbon (in milligrams per liter).

Subpart H – a public water system (PWS) using surface water or ground water under the direct influence of surface water.

Total Organic Carbon (TOC) – total organic carbon in milligrams per liter is measured using heat, oxygen, ultraviolet irradiation, chemical oxidants, or combinations of these oxidants that convert organic carbon to carbon dioxide, rounded to two significant figures.

Acronyms

BAT: Best Available Technology

CDS: Combined Distribution System

CWS: Community Water System

DBP: Disinfection Byproducts

DBPP: Disinfection Byproducts Precursors

DBPR: Disinfectants and Disinfection Byproducts Rule

EC: Enhanced Coagulation

EPA: United States Environmental Protection Agency

ES: Enhanced Softening

FR: *Federal Register*

GAC10: Granular Activated Carbon with 10-minute empty bed contact time and 180-day reactivation frequency

GAC20: Granular Activated Carbon with 20-minute empty bed contact time and 240-day reactivation frequency

GWUDI: Ground Water Under the Direct Influence of Surface Water

HAA5: Haloacetic Acids (five) (chloroacetic acid, dichloroacetic acid, trichloroacetic acid, bromoacetic acid and dibromoacetic acid)

ICR: Information Collection Rule (issued under section 1412(b) of the SDWA)

IDSE: Initial Distribution System Evaluation

LRAA: Locational Running Annual Average

MCL: Maximum Contaminant Level

MCLG: Maximum Contaminant Level Goal

M–DBP: Microbial and Disinfectants/Disinfection Byproducts

mg/L: Milligrams per Liter

MR: Monitoring/Reporting

MRDL: Maximum Residual Disinfectant Level

MRDLG: Maximum Residual Disinfectant Level Goal

nm: Nanometer

NOM: Naturally Occurring Material – A DBPP

NTNCWS: Nontransient Noncommunity Water System

OEL: Operational Evaluation Level

PWS: Public Water System

RAA: Running Annual Average

RTCR: Revised Total Coliform Rule

SDWA: Safe Drinking Water Act

Subpart H: PWS using surface water or ground water under the direct influence of surface water

SUVA: Specific Ultraviolet Absorbance

SWTR: Surface Water Treatment Rule

TNCWS: Transient Noncommunity Water System

TOC: Total Organic Carbon

TTHM: Total Trihalomethanes (chloroform, bromodichloromethane, dibromochloromethane and bromoform)

UV: Ultraviolet

1. Introduction

Purpose of the Guide

The purpose of this guide is to provide an overview of the regulatory requirements of the Stage 1 and Stage 2 Disinfectants and Disinfection Byproducts Rules (DBPRs). The Stage 1 DBPR was published in the *Federal Register* on December 16, 1998 and the Stage 2 DBPR was published in the *Federal Register* on January 4, 2006. The U.S. Environmental Protection Agency (EPA) website provides links to the original rule language as well as the most recent guidance documents and other information (https://www.epa.gov/dwreginfo/stage-1-and-stage-2-disinfectants-and-disinfection-byproducts-rules). With these rules EPA set enforceable limits for disinfectants and disinfection byproducts (DBPs), created monitoring requirements and specify planning and reporting procedures. This guide presents an overview of the rule requirements as well as attachments that provide detailed descriptions of the rule requirements for water systems according to system size, source water type and disinfectant used. Water system operators and other readers should look at the short overview sections (Sections 1-4) at the beginning of this guide and then turn to the specific attachment in Section 5 that apply to their water system.

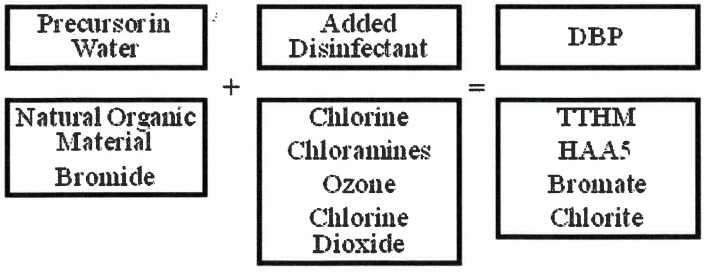
Background

The 1974 Safe Drinking Water Act (SDWA) required EPA to regulate drinking water. Although the SDWA was amended slightly in 1977, 1979 and 1980, the most significant changes occurred when SDWA was reauthorized in 1986. To safeguard public health, the 1986 Amendments required EPA to set health goals, or maximum contaminant level goals (MCLGs) and maximum contaminant levels (MCLs) for 83 contaminants. EPA also was required to establish regulations, require disinfection of water systems (all those using surface water and as necessary, those using ground water), specify filtration requirements for nearly all water systems that draw their water from surface sources and develop additional programs to protect ground water supplies.

THE STAGE 1 AND STAGE 2 DBPRS ARE INTENDED TO HELP CONTROL PATHOGENS WHILE MINIMIZING THE PUBLIC HEALTH RISK FROM DISINFECTANTS AND DBPS.

In 1990, EPA's Science Advisory Board, an independent panel of experts established by Congress, cited drinking water contamination as one of the most important environmental risks and indicated that disease-causing microbial contaminants (such as, bacteria, protozoa and viruses) are the greatest remaining health-risk challenge for drinking water suppliers. Water systems add disinfectants to reduce the risk of these contaminants, but the disinfectants react with naturally occurring materials (NOMs) in the water to form DBPs.

DBP formation is influenced by several factors, including precursor concentrations and water temperature. For instance, DBPs formed from NOMs are produced at a higher rate as the temperature of the water increases. This usually leads to higher disinfectant demand and higher total trihalomethanes (TTHM) and five haloacetic acid (HAA5) concentrations during summer months and in warmer climates. The Stage 1 and Stage 2 DBPRs are intended to minimize the public health risk from DBPs and disinfectants that are used to control pathogens. By



building on the foundation set forth by the original SDWA, the quality of drinking water has improved and public health protection has increased.

To address the complex balance between water disinfection risks and benefits, EPA established maximum residual disinfectant levels (MRDLs) for chlorine, chloramines and chlorine dioxide, and MCLs for DBPs (chlorite, bromate, TTHM and HAA5). The Stage 1 and Stage 2 DBPRs require all community water systems (CWSs) and nontransient noncommunity water systems (NTNCWSs) that use a primary or residual disinfectant other than ultraviolet (UV) light or deliver water that has been treated with a primary or residual disinfectant other than UV light to comply with all monitoring requirements associated with the:

- MCL for TTHM and HAA5.
- MRDL for chlorine or chloramines.
- MCL for bromate (for systems that use ozone).
- MRDL for chlorine dioxide (for systems that use chlorine dioxide).
- MCL for chlorite (for systems that use chlorine dioxide).

Transient noncommunity water systems (TNCWSs) that use chlorine dioxide, must comply with the MRDL for chlorine dioxide. In addition, water systems with a surface or ground water under the direct influence of surface water source (Subpart H systems) that use conventional filtration must comply with the treatment technique requirement and remove NOMs measured as total organic carbon (TOC) that may react with disinfectants to form DBPs.

Following promulgation of the Stage 1 DPBR, EPA determined that the required monitoring sites may not be representative of higher DBP concentrations that occur in distribution systems. Therefore, the Stage 2 DPBR was promulgated to require more consistent and equitable protection from DBPs across the entire distribution system, reduce DBP peaks and ultimately, provide more equitable public health protection. To achieve this CWSs and NTNCWSs that serve 10,000 or more persons were required to conduct an evaluation of their water system's distribution systems. This evaluation, called an Initial Distribution System Evaluation (IDSE), was used to identify the areas in the distribution system with high DBPs concentrations. The sample sites identified in the IDSE are used by CWSs and NTNCWSs as the basis for selecting their TTHM and HAA5 compliance monitoring sites. The IDSE requirement was a one-time requirement and all CWSs and NTNCWSs serving 10,000 or more persons should have completed their IDSE.

This guide addresses the ongoing monitoring required by the Stage 1 and Stage 2 DBPRs.

2. Applicability and Compliance Dates

The Stage 1 DBPR analytical and monitoring requirements for chlorine, chloramines, bromate, chlorine dioxide and chlorite apply to all CWSs and NTNCWSs *that add a chemical disinfectant to the water in any part of the drinking water treatment process*. In addition, certain requirements apply to TNCWSs that use chlorine dioxide. The Stage 2 DBPR analytical and monitoring requirements for TTHM and HAA5 apply to all CWSs and NTNCWSs that either add a primary or residual disinfectant other than UV light, or deliver water that has been treated with a primary or residual disinfectant other than UV light. Consecutive systems that do not add a disinfectant but deliver water that was treated with a disinfectant other than UV light must also comply with the

COMPLIANCE DATES DEPEND ON THE POPULATION SERVED BY THE SYSTEM OR THE LARGEST SYSTEM WITHIN A COMBINED DISTRIBUTION SYSTEM.

Stage 1 DBPR analytical and monitoring requirements for chlorine and chloramines and associated compliance and reporting requirements.

Under the Stage 2 DPBR, compliance dates are dependent on the population served by a system or the population served by the largest system within a combined distribution system (CDS). A CDS is an interconnected distribution system consisting of the distribution systems of wholesale systems and of the consecutive systems that receive some or all of their finished water from those wholesale systems.

Table 1 - Stage 2 DBPR TTHM and HAA5 Compliance Monitoring Compliance Dates

IF YOU ARE THIS TYPE OF SYSTEM	YOU MUST HAVE BEGUN COMPLYING WITH SUBPART V TTHM/HAA5 MONITORING BY: [1]
Systems that are not part of a combined distribution system and systems that serve the largest population in the combined distribution system	
(1) System serving ≥100,000	April 1, 2012
(2) System serving 50,000-99,999	October 1, 2012
(3) System serving 10,000-49,999	October 1, 2013
(4) System serving <10,000	October 1, 2013 if no *Cryptosporidium* monitoring is required under Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) OR October 1, 2014 if *Cryptosporidium* monitoring is required under LT2ESWTR
Other systems that are part of a combined distribution system	
(5) Consecutive system or wholesale system	at the same time as the system with the earliest compliance date in the combined distribution system

3. Summary of Regulatory Requirements

MRDLGs and MRDLs for disinfectants only; MCLGs and MCLs for disinfection byproducts

EPA established maximum residual disinfectant level goals (MRDLGs) and MRDLs for three chemical disinfectants – chlorine, chloramine and chlorine dioxide – and established MCLGs and MCLs for TTHM, HAA5, chlorite and bromate, as described in the tables below. All MCLs and MRDLs are in milligrams per liter (mg/L).

Table 2 - Regulated Disinfectants

Regulated Disinfectants	MRDL (mg/L)	MRDLG (mg/L)
Chlorine	4.0 as Cl_2	4 as Cl_2
Chloramines	4.0 as Cl_2	4 as Cl_2
Chlorine dioxide	0.8 as ClO_2	0.8 as ClO_2

[1] The state may grant up to an additional 24 months for compliance with MCLs and operational evaluation levels if the water system is required to make capital improvements to comply with an MCL.

Table 3 - Regulated Contaminants

Regulated Contaminants	MCL (mg/L)	MCLG (mg/L)
TTHM	0.080	Three individual MCLGs were established: Bromodichloromethane at Zero Dibromochloromethane at 0.06 Bromoform at Zero
HAA5	0.060	Two individual MCLGs were established: Dichloroacetic acid at Zero Trichloroacetic acid at 0.3
Bromate (plants that use ozone)	0.010	Zero
Chlorite (plants that use chlorine dioxide)	1.0	0.8

Monitoring plan

Each water system must develop and implement a monitoring plan that details how it will meet all applicable requirements. The monitoring plan must include specific locations and schedules for collecting samples, and how the water system will calculate compliance with MCLs, MRDLs and removal requirements. The monitoring plan must be kept on file for state and public review, and must contain monitoring plans for any other systems in the CDS if the state has allowed combined monitoring.

Laboratory methods and certification

Analysis for DBPs must be conducted by laboratories that have been certified by EPA or the state. Chlorite measured at the entrance to the distribution system is a trigger, not an MCL compliance sample, and may be analyzed by a party approved by the state. For disinfectants and other specified parameters that EPA believes can be adequately measured on-site (for example, for samples that may deteriorate before reaching a certified laboratory), EPA requires that analyses be conducted by a party approved by the state. Additional information on approved methods can be found on EPA's website at: https://www.epa.gov/dwanalyticalmethods.

Monitoring

EPA has developed compliance monitoring schemes for each MRDL, MCL and treatment technique to be protective of acute and chronic health concerns. The compliance monitoring requirements vary by the size and type of the water system, the treatment employed and the disinfectant used. In many cases, water systems may reduce monitoring frequencies after establishing a baseline. In some cases, water systems that exceed an MCL or MRDL may need to increase the number of samples or monitoring frequency.

Compliance

Compliance is based on a running annual average (RAA) calculated quarterly, locational running annual average (LRAA) calculated quarterly, a single sample result or an average of a selected number of samples, depending on which disinfectant or DBP is being monitored.

Water systems must notify the public and report to the state if they are in violation of an MCL, MRDL or treatment technique. If a water system fails to monitor, the system is in violation of the monitoring requirements for each quarter that the monitoring result would have been used in calculating compliance. All violations require public notification.[2] All samples taken and analyzed under the provisions of the monitoring plan must be included in determining compliance, even if there are more than the minimum required.

A water system is considered in violation if the RAA or LRAA of all samples for a consecutive 4-quarter period exceeds the MCL or MRDL. The system would also be in violation of the MCL or MRDL if they will exceed the MCL or MRDL based on fewer than 4 quarters of data and regardless of the monitoring results of subsequent quarters.

> *If the sum of 3 quarters of sampling causes a water system to exceed the MCL even with a 4th quarter sample of 0 mg/L, the water system has an MCL violation after 3 quarters. For example, Quarter 1 = 0.009, Quarter 2 = 0.010, Quarter 3 = 0.015; Average = 0.011 for first three quarters. Average exceeds the MCL after 3 quarters, water system is in violation of the MCL.*

Public water system recordkeeping and reporting requirements

Water systems required to sample quarterly or more frequently must report to the state within 10 days after the end of each quarter in which samples were collected. Those required to sample less frequently than quarterly must report to the state within 10 days after the end of each monitoring period in which samples were collected. Systems that are required to conduct additional monitoring because of the disinfectant used (for example, chlorine dioxide) are subject to additional reporting requirements if certain chemical levels are measured.

Operational evaluation levels

EPA included operational evaluation levels (OELs) for TTHM and HAA5 in order to better track contaminant levels in drinking water. TTHM and HAA5 OELs must be calculated by all water systems required to comply with the TTHM and HAA5 MCLs. An OEL is calculated as the sum of the 2 previous quarters' sample results plus twice the current quarter's result, divided by four to determine an average. An OEL for TTHM is exceeded at any monitoring location where the OEL is greater than 0.080 mg/L. For HAA5, the OEL is exceeded at any monitoring location where the OEL is greater than 0.060 mg/L.

If you exceed an OEL, you must conduct an operational evaluation and submit a written report to the state no later than 90 days after receiving the exceedance result. The evaluation must include an examination of system treatment and distribution practices, including storage tank operations, excess storage capacity, distribution system flushing,

Operational Evaluation Level

$$\frac{(Q_1 + Q_2 + 2Q_3)}{4} < MCL$$

Where Q_1 is the TTHM or HAA5 quarterly sample result from two quarters ago, Q_2 is the result from last quarter, and Q_3 is the most recent result (current quarter) which is then multiplied by 2 to predict possible level for the next quarter.

[2] Failure to take distribution system samples the day an entry point sample exceeded the chlorine dioxide MRDL is a monitoring violation and requires Tier 1 public notice be provided, not Tier 3 public notice.

changes in sources or source water quality and treatment changes. The report must be made available to the public upon request. The scope of the evaluation may be limited, if the water system is able to identify the cause of the OEL exceedance. EPA developed a guidance manual that describes the requirements for operational evaluations and provides guidance for documenting and reporting OEL exceedances. This guidance manual is available on EPA's website (https://www.epa.gov/dwreginfo/stage-1-and-stage-2-disinfectants-and-disinfection-byproducts-rules).

Best available technology

EPA specified best available technologies (BATs) for each MCL and MRDL. These technologies and methods are believed to be effective in controlling chemicals in drinking water while remaining economically feasible. Public water systems (PWSs) must use the specified BAT if they wish to qualify for variances; otherwise, systems are not required to install a BAT and may use any approved technology to achieve compliance.

Table 4 – DBPRs Best Available Technology Options

Disinfectant or DBP	Contaminant/ Disinfectant	Best Available Technology
DBPs	TTHM and HAA5	Enhanced coagulation or enhanced softening with granular activated carbon with an empty bed contact time of ten minutes (GAC10) or granular activated carbon with an empty bed contact time of 20 minutes (GAC20), with chlorine as the primary and residual disinfectant, or nanofiltration with a maximum filter weight of 1,000 Daltons.
DBPs	Chlorite	Control of treatment processes to reduce disinfectant demand and control of disinfection treatment processes to reduce disinfectant levels.
DBPs	Bromate	Control of ozone treatment process to reduce production of bromate.
Disinfectants	Chlorine, chloramine and chlorine dioxide	Control of treatment processes to reduce disinfectant demand and control of disinfection treatment processes to reduce disinfectant levels.

Treatment technique for disinfection byproduct precursors

EPA specified a treatment technique that applies to Subpart H systems using conventional filtration treatment. The treatment technique requirements are designed to provide public health protection by minimizing DBP precursors (DBPPs) and thus the production of all DBPs. Compliance with the treatment technique can be achieved by removing specified percentages of TOC using enhanced coagulation or enhanced softening. The required TOC removal is listed in the table below.

Table 5 - Step 1 TOC - Required Percent Removal of TOC

Source Water TOC (mg/L)	Source Water Alkalinity, mg/L as CaCO3		
	0-60	> 60-120	>120
> 2.0 to 4.0	35.0%	25.0%	15.0%
> 4.0 to 8.0	45.0%	35.0%	25.0%
> 8.0	50.0%	40.0%	30.0%

When providing TOC removal, Subpart H systems may show that they meet alternative compliance criteria. For example, a system that has less than 2.0 mg/L TOC in its source or treated water meets an alternative compliance criterion. Another criterion allows the system to be in compliance if the RAA of a system's source water TOC is less than 4.0 mg/L, the RAA of source water alkalinity is greater than 60 mg/L, and either the TTHM RAA is less than or equal to 0.040 mg/L and the HAA5 RAA is less than or equal to 0.030 mg/L, or the state has determined that the system has made a clear and irrevocable commitment to installing technology to limit TTHM and HAA5 to those levels. For those systems using Specific Ultraviolet Absorption (SUVA) as an alternative compliance criterion they must be less than or equal to 2.0 L/mg-m, calculated quarterly as a RAA. See Attachment 6 for specific information on alternative compliance criteria.

4. Additional Information

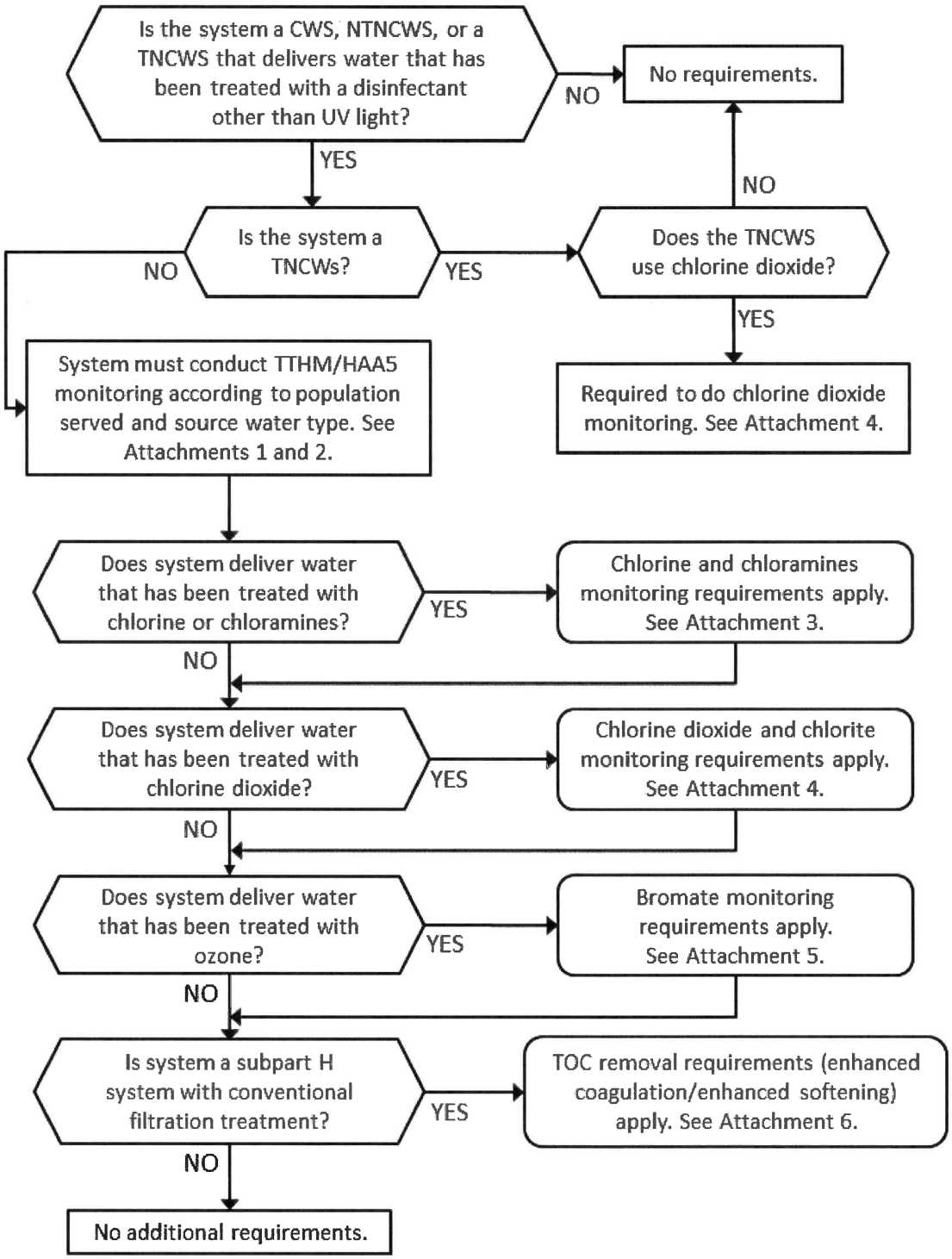
A series of guidance manuals have been developed to support the Stage 1 and Stage 2 DBPR. They are available on EPA's website (https://www.epa.gov/dwreginfo/stage-1-and-stage-2-disinfectants-and-disinfection-byproducts-rules) and are also available free of charge through the National Service Center for Environmental Publications (https://www.epa.gov/nscep). The manuals can help water system operators, state agencies and EPA implement drinking water regulations consistently and effectively.

5. Detailed Regulatory Requirements

Detailed descriptions of the monitoring requirements for PWSs are presented in the following sections. The Stage 1 and Stage 2 DBPR apply to all CWSs and NTNCWSs that add a disinfectant other than UV light, or deliver water that has been treated with any disinfectant other than UV light, as well as TNCWSs that treat their water with chlorine dioxide. However, systems must monitor at particular frequencies and locations depending on source water type (Subpart H and ground water) and population served by the system. Additionally, monitoring requirements for specific chemicals will vary depending on system type and the primary disinfectant used. For this reason, the monitoring requirements are presented in separate attachments for each system size and type.

This section is organized into separate attachments so that specific categories of systems can turn to their specific requirements. Keep in mind that some systems may fall into more than one category. Use the flowchart on the next page to determine which of the attachments apply to your water system.

Disinfectant and Disinfection Byproduct Rules General Requirements



Attachment 1: CWSs and NTNCWSs use a primary or residual disinfectant other than ultraviolet (UV) light or deliver water that has been treated with a primary or residual disinfectant other than UV light

Monitoring Location Site Selection Protocol

If you treat water with a chemical disinfectant, or deliver water that has been treated with a chemical disinfectant, you must identify in your monitoring plan the locations with representative high TTHM and HAA5 concentrations in your distribution system.

The number of required sampling sites for TTHM and HAA5 compliance monitoring will depend on your source type and population served by the system. Please refer to the appropriate flowchart in this attachment for the number of sample sites that you must identify.

The site selection protocol below explains how you must select your TTHM and HAA5 monitoring locations:

Step #	Criteria	Site
1	Select the location with the highest TTHM LRAA	1st highest TTHM site
2	Select the remaining location with the highest HAA5 LRAA	1st highest HAA5 site
3	For subpart H systems: Select the remaining existing Stage 1 DBPR average residence time compliance monitoring location with the highest HAA5 LRAA For ground water systems: Select the remaining existing Stage 1 DBPR maximum residence time compliance monitoring location with the highest HAA5 LRAA Skip this step if you have no more Stage 1 DBPR sites	1st Stage 1 DBPR site
4	Select the remaining location with the next highest TTHM LRAA	2nd highest TTHM site
5	Select the remaining location with the next highest TTHM LRAA	3rd highest TTHM site
6	Select the remaining location with the next highest HAA5 LRAA	2nd highest HAA5 site
7	For subpart H systems: Select the remaining existing Stage 1 DBPR average residence time compliance monitoring location with the highest TTHM LRAA For ground water systems: Select the remaining existing Stage 1 DBPR maximum residence time compliance monitoring location with the highest TTHM LRAA Skip this step if you have no more Stage 1 DBPR	2nd Stage 1 DBPR site
8	Select the remaining location with the next highest HAA5 LRAA	3rd highest HAA5 site

Notes:

- If you need more compliance monitoring locations, go back to Step 1 of this protocol and repeat the steps until you have selected the required number of total sites.
- You may recommend locations other than those listed in the protocol if you provide a rationale for selecting other locations and your state approves of the alternate locations.

Routine Monitoring

If you treat water with a chemical disinfectant, or deliver water that has been treated with a chemical disinfectant, the number and frequency of TTHM/HAA5 samples you must take depends on your system's source type and the size of the population served. If you are required to monitor quarterly, you

must take dual sample sets every 90 days at each monitoring location included in your monitoring plan. If you are required to monitor TTHM/HAA5 annually, you are only required to take individual samples annually at the locations with the highest TTHM and HAA5 concentrations, respectively.

Increased Monitoring

If you monitor annually or less frequently than annually and a TTHM sample exceeds 0.080 mg/L or a HAA5 sample exceeds 0.060 mg/L at any location, you must increase monitoring frequency to dual sample sets once per quarter (taken every 90 days) at all monitoring locations. You may return to routine monitoring if the TTHM LRAA for every monitoring location is less than or equal to 0.060 mg/L and the HAA5 LRAA for every monitoring location is less than or equal to 0.045 mg/L after conducting at least four consecutive quarters of increased monitoring.

Reduced Monitoring

If you qualify and your state allows, you may be able to reduce your monitoring for TTHM and HAA5 LRAAs. Remember, TTHM and HAA5 monitoring requirements are tied together. In order to reduce the water system's monitoring frequency, your system must meet the qualifications for both TTHM and HAA5 reduced monitoring and the state must approve. In addition, if you exceed the MCL for either TTHM or HAA5 while on reduced monitoring, you must increase or return to routine monitoring for both TTHM and HAA5.

- For qualified systems on **reduced quarterly monitoring**, you may remain on reduced monitoring as long as the TTHM LRAA is less than or equal to 0.040 mg/L and the HAA5 LRAA is less than equal to 0.030 mg/L at each monitoring location.
- For qualified systems on **reduced annual or less frequent monitoring**, you may remain on a reduced monitoring schedule as long as each TTHM sample is less than or equal to 0.060 mg/L and each HAA5 sample is less than or equal to 0.045 mg/L.
- In addition, qualified **Subpart H systems on reduced monitoring** schedule must maintain a source water annual average TOC level, before any treatment, of less than or equal to 4.0 mg/L at each Subpart H treatment plant.

If your system fails to meet the criteria list above at any of the sampling locations, you must return to routine monitoring.

Compliance

You are in violation if the LRAA for any monitoring location covering any consecutive 4-quarter period exceeds the TTHM MCL of 0.080 mg/L or HAA5 MCL of 0.060 mg/L. If your LRAA, based on fewer than 4 quarters of data exceeds one of the MCLs regardless of the monitoring results of subsequent quarters you would be in violation. If you fail to monitor, you are in violation of the monitoring requirements for each quarter that the missed monitoring result would have been used in the compliance calculation.

You must calculate your LRAA based on the quarterly results at each site for the previous consecutive 4-quarter period.[3] The table below provides an example TTHM LRAA calculation (results reported in mg/L). For example, the LRAA for the 4th quarter of 2013 is the average of the quarterly results from

[3] Stage 2 DBPR compliance can also be based on a single sample result (if the result is 4 times the MCL). If your system monitors once a year or less often, you should use your single sample result to determine compliance.

quarters 1-4 in 2013. Note that the reported LRAAs for quarters 1-3 in 2013 are based on results from previous quarters not reported on this table.

Table 1.1 - TTHM Monitoring Results

Sample Sites	1st quarter 2013	2nd quarter 2013	3rd quarter 2013	4th quarter 2013	1st quarter 2014	2nd quarter 2014
Site 1 Quarterly Results	0.045	0.060	0.125	0.070	0.041	0.064
Site 1 - LRAA	0.047	0.051	0.074	0.075	0.074	0.075
Site 2 Quarterly Results	0.040	0.055	0.115	0.060	0.044	0.065
Site 2 – LRAA	0.042	0.049	0.071	0.068	0.069	0.071

You must calculate a LRAA for each of the TTHM and HAA5 sample sites.

If an OEL is exceeded at any monitoring location, you must conduct an operational evaluation and submit a written report of the evaluation to the state within 90 days. An OEL exceedance occurs when the sum of the two previous quarters' results plus twice the current quarter's result, divided by four to determine an average, exceeds an MCL.

Reporting

You must report to the state within 10 days after the end of each quarter. You must report the number of TTHM and HAA5 samples taken during the last 3 months, and the location, date and result of each sample taken during the last quarter. You must report the LRAAs of all quarterly samples, however the state may choose to perform this calculation and determine if the MCL was exceeded. If an LRAA calculation based on fewer than 4 quarters of data would cause the MCL to be exceeded regardless of the monitoring results of subsequent quarters, you must submit this information to the state.

If you are a Subpart H system looking to qualify or remain on reduced monitoring, you must also report your RAA of every 30 days or every 90 days TOC samples and whether or not you exceed 4.0 mg/L.

You must report any OELs that were exceeded, including location, date and the calculated TTHM and HAA5 levels. You must submit a written report to the state no later than 90 days after being notified of the result that causes your system to exceed the OEL.

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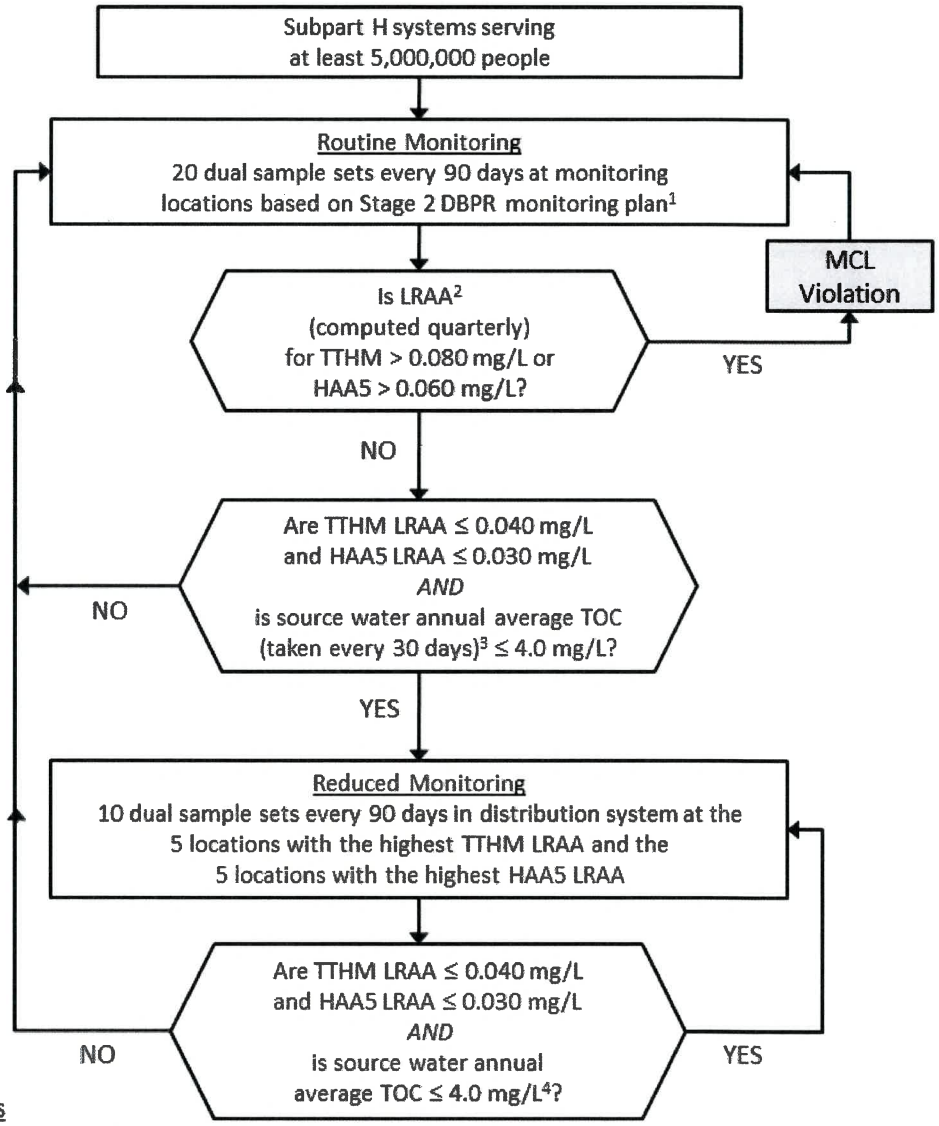
Attachment 2: TTHM and HAA5 monitoring for systems that deliver water that has been treated with a disinfectant other than UV light

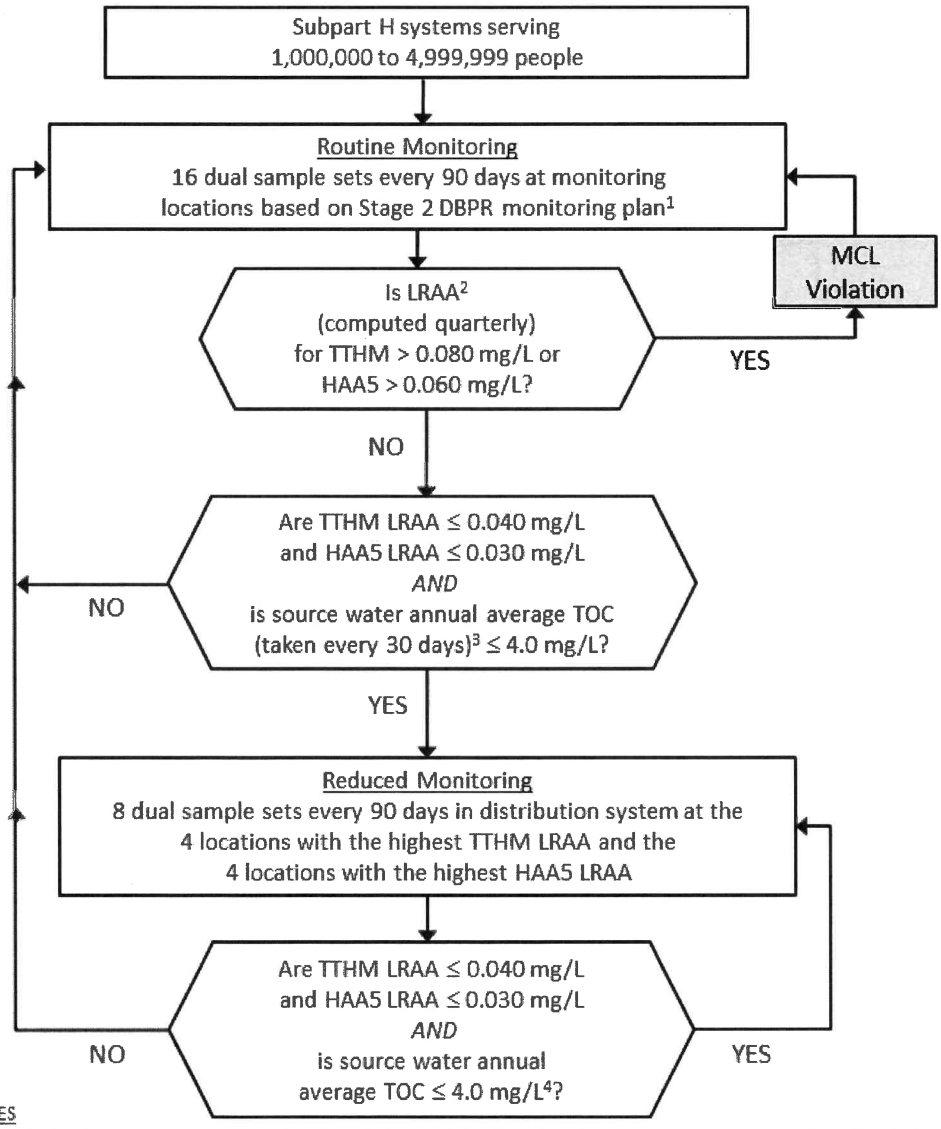
TTHM and HAA5 monitoring requirements for Subpart H systems that deliver water that has been treated with a disinfectant other than UV light and the largest system in the CDS serves at least 5,000,000 people



NOTES

1. Monitoring locations must be based on Stage 2 DPBR monitoring plan. See Attachment 1 for an explanation of the site selection protocol.
2. Systems must calculate the arithmetic average of results for each monitoring location, and an exceedance at any location is an MCL violation. If a PWS fails to complete 4 consecutive quarters of monitoring, compliance with the MCL for the last 4-quarter period must be based on the average of available data.
3. Subpart H systems which use conventional filtration must monitor for TOC monthly instead of every 30 days.
4. Subpart H systems that do not use conventional filtration qualify for reduced TTHM and HAA5 monitoring, a system may reduce source water TOC monitoring to TOC samples taken every 90 days. Subpart H systems using conventional filtration must remain on monthly TOC monitoring until the system's annual average treated water TOC < 2.0 mg/L for 2 consecutive years or < 1.0 mg/L for one year. After systems meet this requirement, they can reduce TOC monitoring from monthly to quarterly.

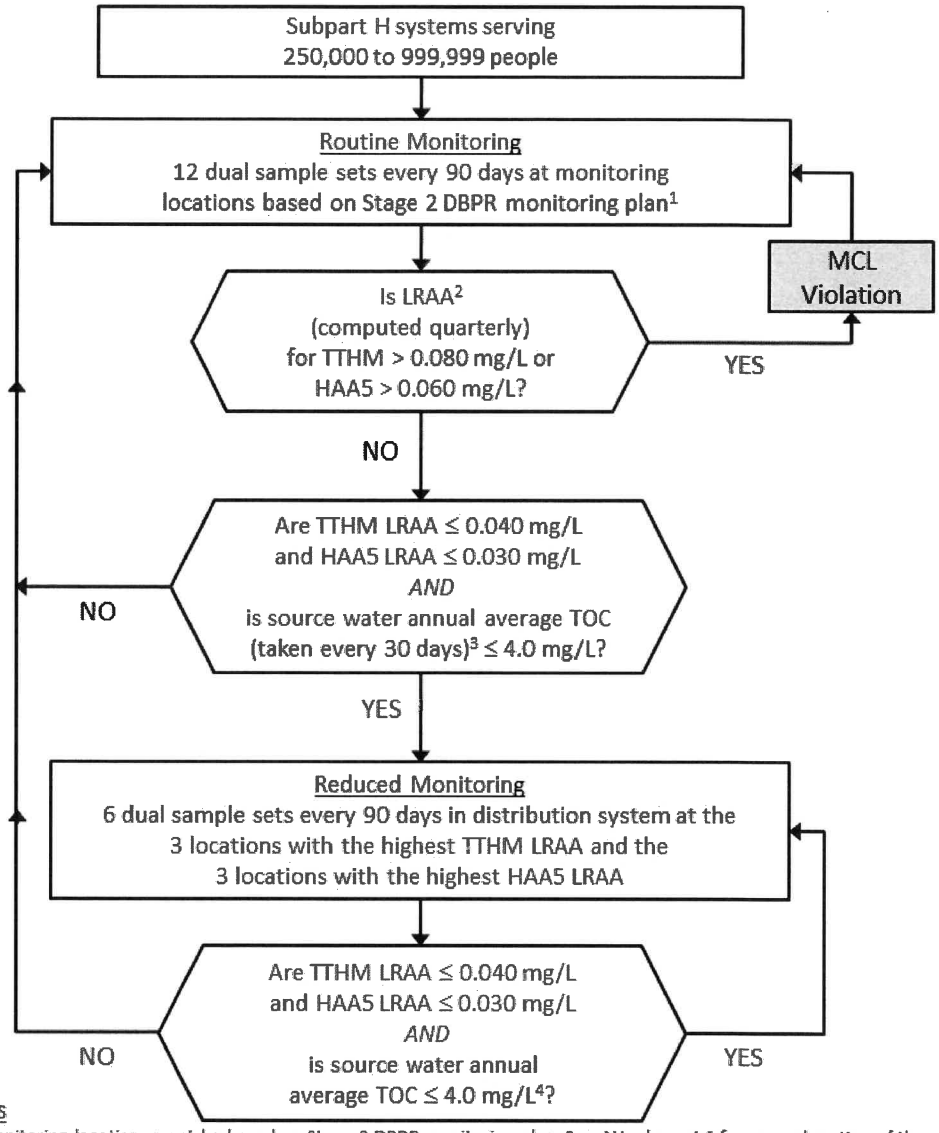
TTHM and HAA5 monitoring requirements for Subpart H systems that deliver water that has been treated with a disinfectant other than UV light and the largest system in the CDS serves 1,000,000 to 4,999,999 people



NOTES

1. Monitoring locations must be based on Stage 2 DPBR monitoring plan. See Attachment 1 for an explanation of the site selection protocol.
2. Systems must calculate the arithmetic average of results for each monitoring location, and an exceedance at any location is an MCL violation. If a PWS fails to complete 4 consecutive quarters of monitoring, compliance with the MCL for the last 4-quarter period must be based on the average of available data.
3. Subpart H systems which use conventional filtration must monitor for TOC monthly instead of every 30 days.
4. Subpart H systems that do not use conventional filtration qualify for reduced TTHM and HAA5 monitoring, a system may reduce source water TOC monitoring to TOC samples taken every 90 days. Subpart H systems using conventional filtration must remain on monthly TOC monitoring until the system's annual average treated water TOC < 2.0 mg/L for 2 consecutive years or < 1.0 mg/L for one year. After systems meet this requirement, they can reduce TOC monitoring from monthly to quarterly.

TTHM and HAA5 monitoring requirements for Subpart H systems that deliver water that has been treated with a disinfectant other than UV light and the largest system in the CDS serves 250,000 to 999,999 people



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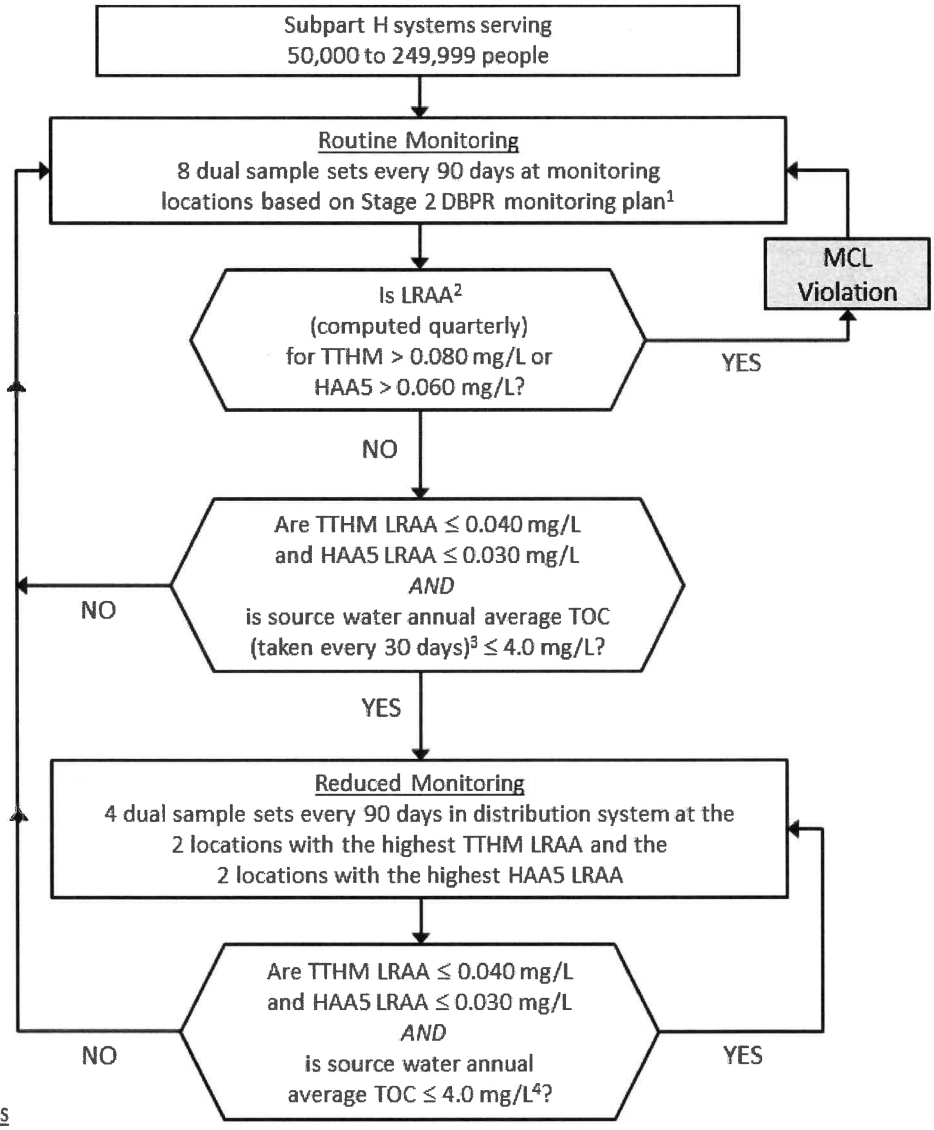
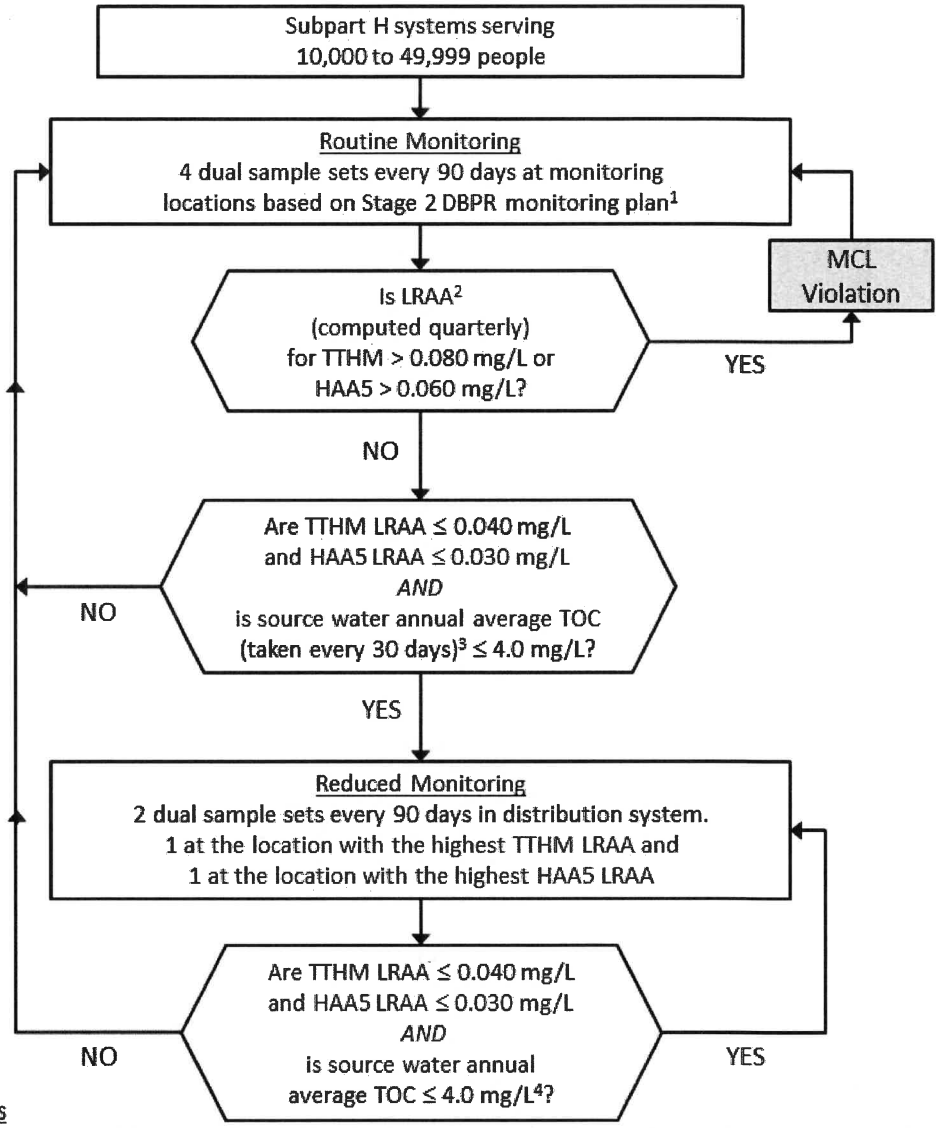
THM and HAA5 monitoring requirements for Subpart H systems that deliver water that has been treated with a disinfectant other than UV light and the largest system in the CDS serves 50,000 to 249,999 people



NOTES

1. Monitoring locations must be based on Stage 2 DBPR monitoring plan. See Attachment 1 for an explanation of the site selection protocol.
2. Systems must calculate the arithmetic average of results for each monitoring location, and an exceedance at any location is an MCL violation. If a PWS fails to complete 4 consecutive quarters of monitoring, compliance with the MCL for the last 4-quarter period must be based on the average of available data.
3. Subpart H systems which use conventional filtration must monitor for TOC monthly instead of every 30 days.
4. Subpart H systems that do not use conventional filtration qualify for reduced TTHM and HAA5 monitoring, a system may reduce source water TOC monitoring to TOC samples taken every 90 days. Subpart H systems using conventional filtration must remain on monthly TOC monitoring until the system's annual average treated water TOC < 2.0 mg/L for 2 consecutive years or < 1.0 mg/L for one year. After systems meet this requirement, they can reduce TOC monitoring from monthly to quarterly.

TTHM and HAA5 monitoring requirements for Subpart H systems that deliver water that has been treated with a disinfectant other than UV light and the largest system in the CDS serves 10,000 to 49,999 people



NOTES

1. Monitoring locations must be based on Stage 2 DPBR monitoring plan. See Attachment 1 for an explanation of the site selection protocol.
2. Systems must calculate the arithmetic average of results for each monitoring location, and an exceedance at any location is an MCL violation. If a PWS fails to complete 4 consecutive quarters of monitoring, compliance with the MCL for the last 4-quarter period must be based on the average of available data.
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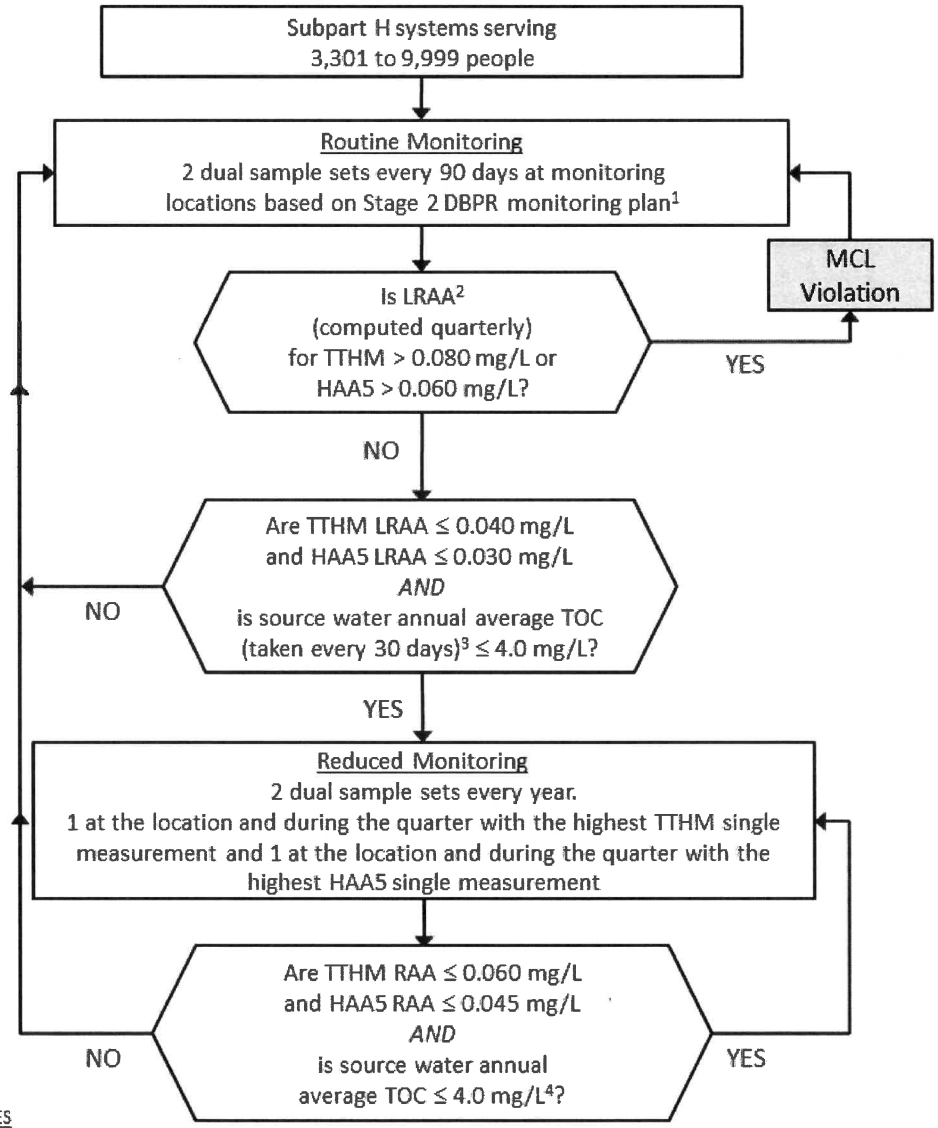
TTHM and HAA5 monitoring requirements for Subpart H systems that deliver water that has been treated with a disinfectant other than UV light and the largest system in the CDS serves 3,301 to 9,999 people



NOTES

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2. Systems must calculate the arithmetic average of results for each monitoring location, and an exceedance at any location is an MCL violation. If a PWS fails to complete 4 consecutive quarters of monitoring, compliance with the MCL for the last 4-quarter period must be based on the average of available data.
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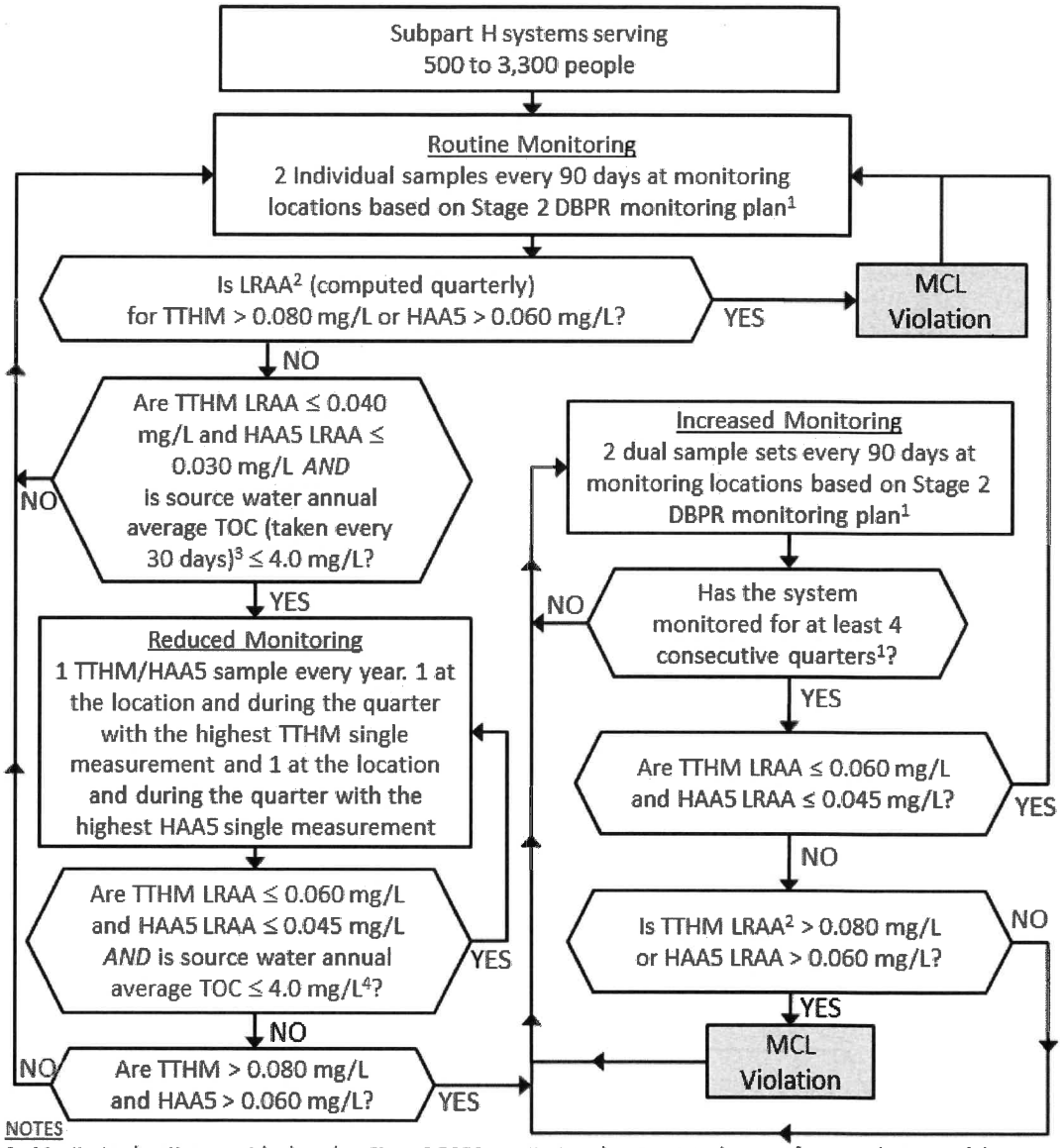
TTHM and HAA5 monitoring requirements for Subpart H systems that deliver water that has been treated with a disinfectant other than UV light and the largest system in the CDS serves 500 to 3,300 people



NOTES

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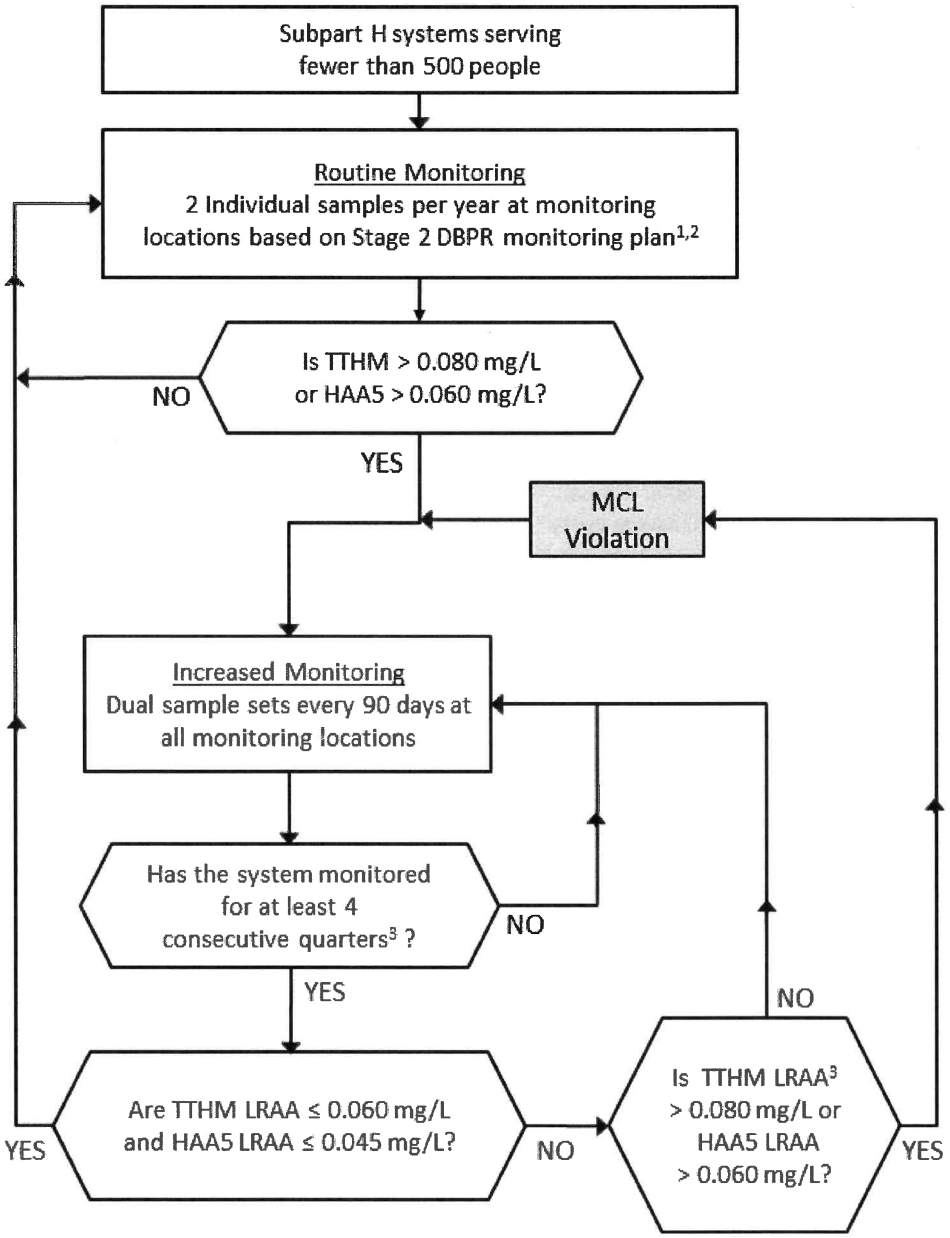
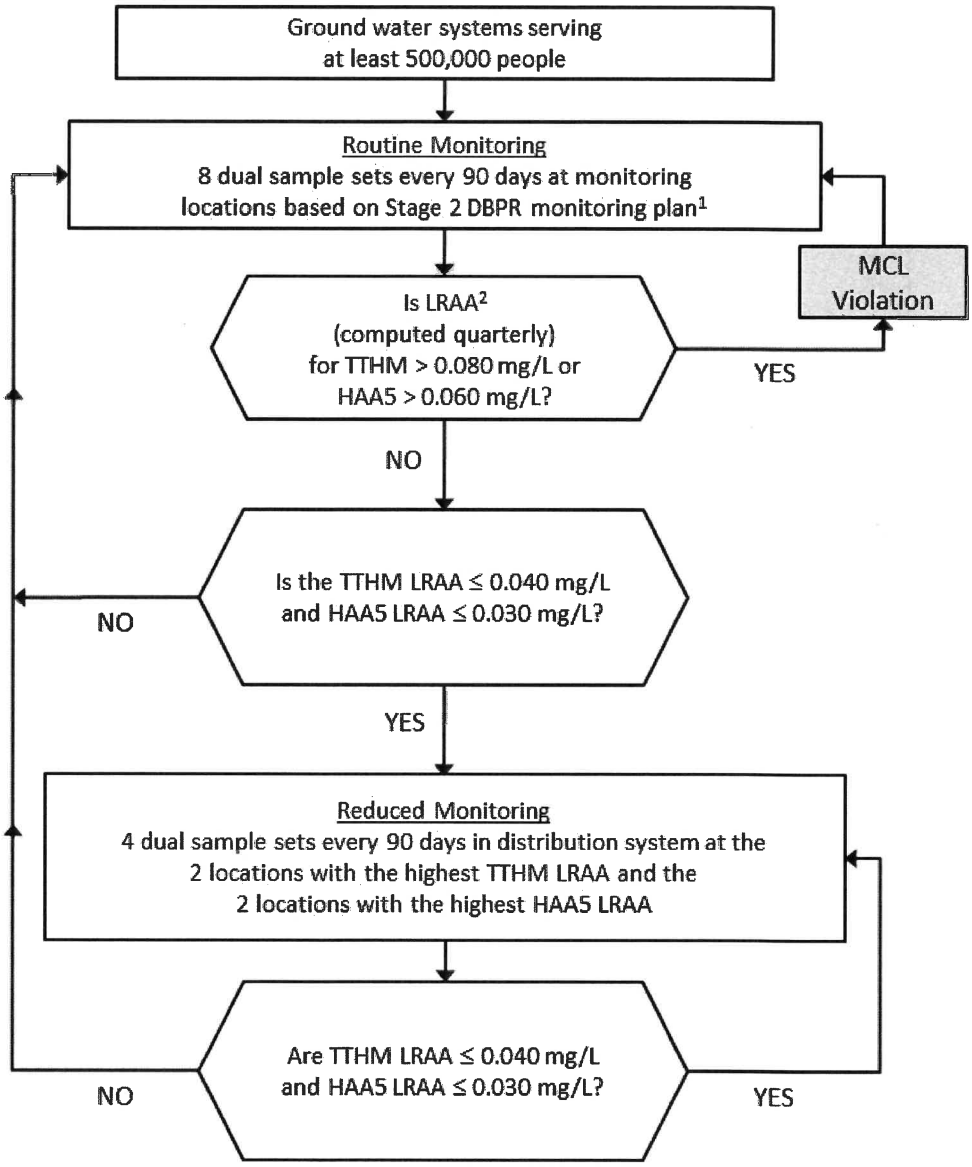
TTHM and HAA5 monitoring requirements for Subpart H systems that deliver water that has been treated with a disinfectant other than UV light and the largest system in the CDS serves fewer than 500 people



NOTES

1. Only one dual sample set at one monitoring location per year is needed if the highest TTHM and HAA5 concentrations occur at the same location and month.
2. Monitoring locations must be based on Stage 2 DPBR monitoring plan. See Attachment 1 for an explanation of the site selection protocol.
3. Systems must calculate the arithmetic average of results for each monitoring location. If a PWS fails to complete 4 consecutive quarters of monitoring, compliance with the MCL for the last 4-quarter period must be based on the average of available data.

TTHM and HAA5 monitoring requirements for ground water systems that deliver water that has been treated with a disinfectant other than UV light and the largest system in the CDS serves at least 500,000 people



NOTES

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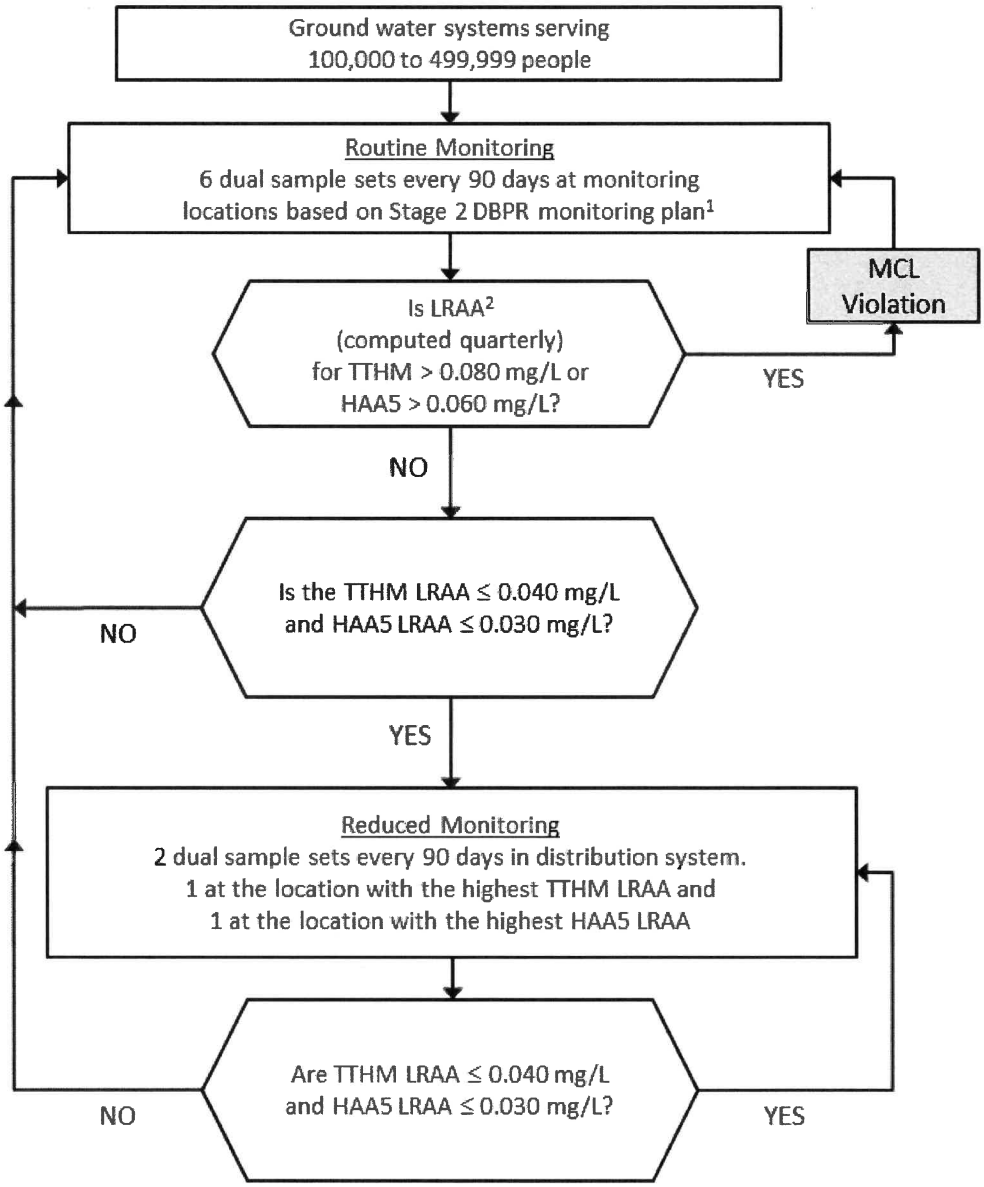
2. Systems must calculate the arithmetic average of results for each monitoring location, and an exceedance at any location is an MCL violation. If a PWS fails to complete 4 consecutive quarters of monitoring, compliance with the MCL for the last 4-quarter period must be based on the average of available data.

TTHM and HAA5 monitoring requirements for ground water systems that deliver water that has been treated with a disinfectant other than UV light and the largest system in the CDS serves 100,000 to 499,999 people

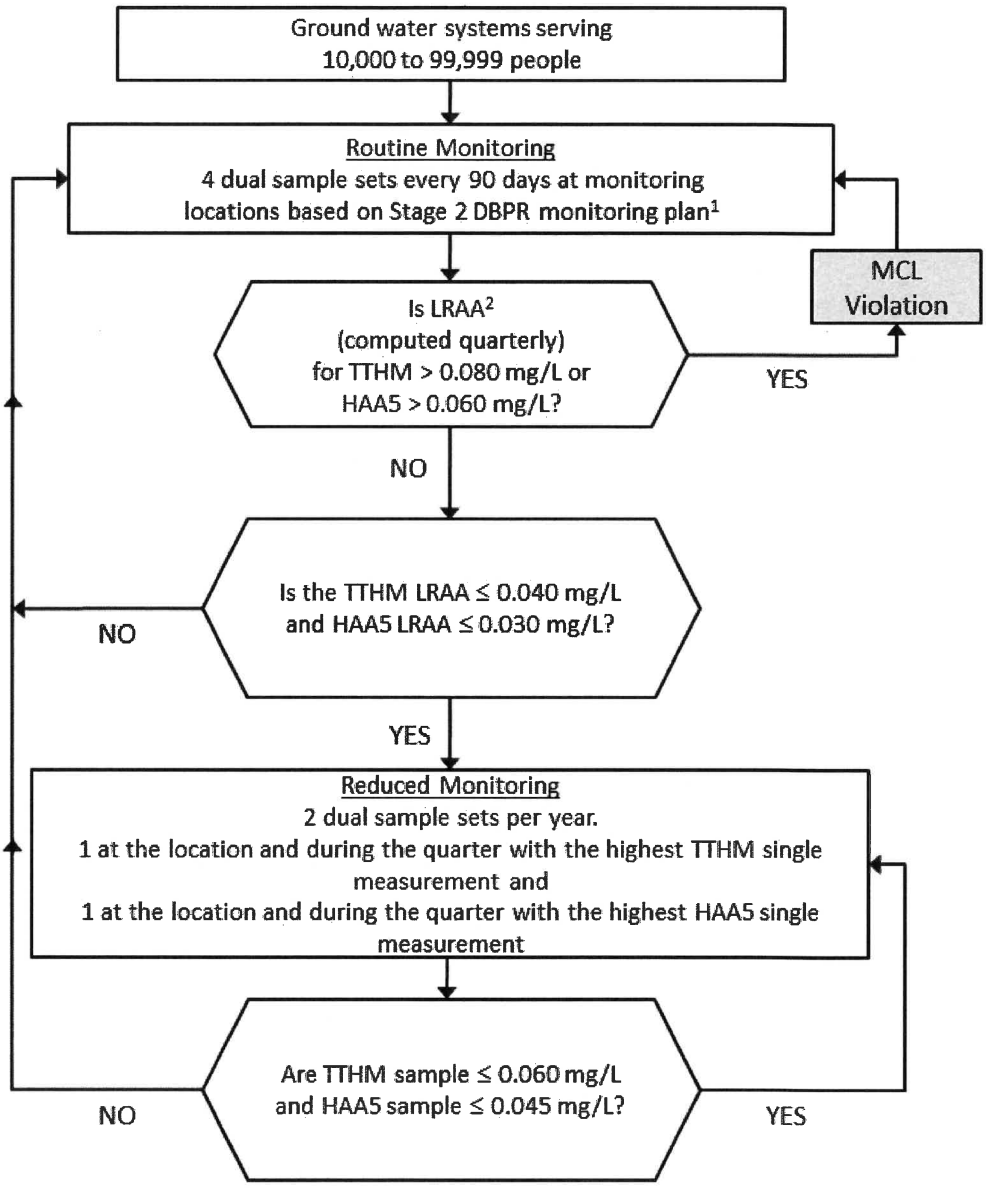


NOTES

1 Monitoring locations must be based on Stage 2 DBPR monitoring plan. See Attachment 1 for an explanation of the site selection protocol.

2. Systems must calculate the arithmetic average of results for each monitoring location, and an exceedance at any location is an MCL violation. If a PWS fails to complete 4 consecutive quarters of monitoring, compliance with . the MCL for the last 4-quarter period must be based on the average of available data.

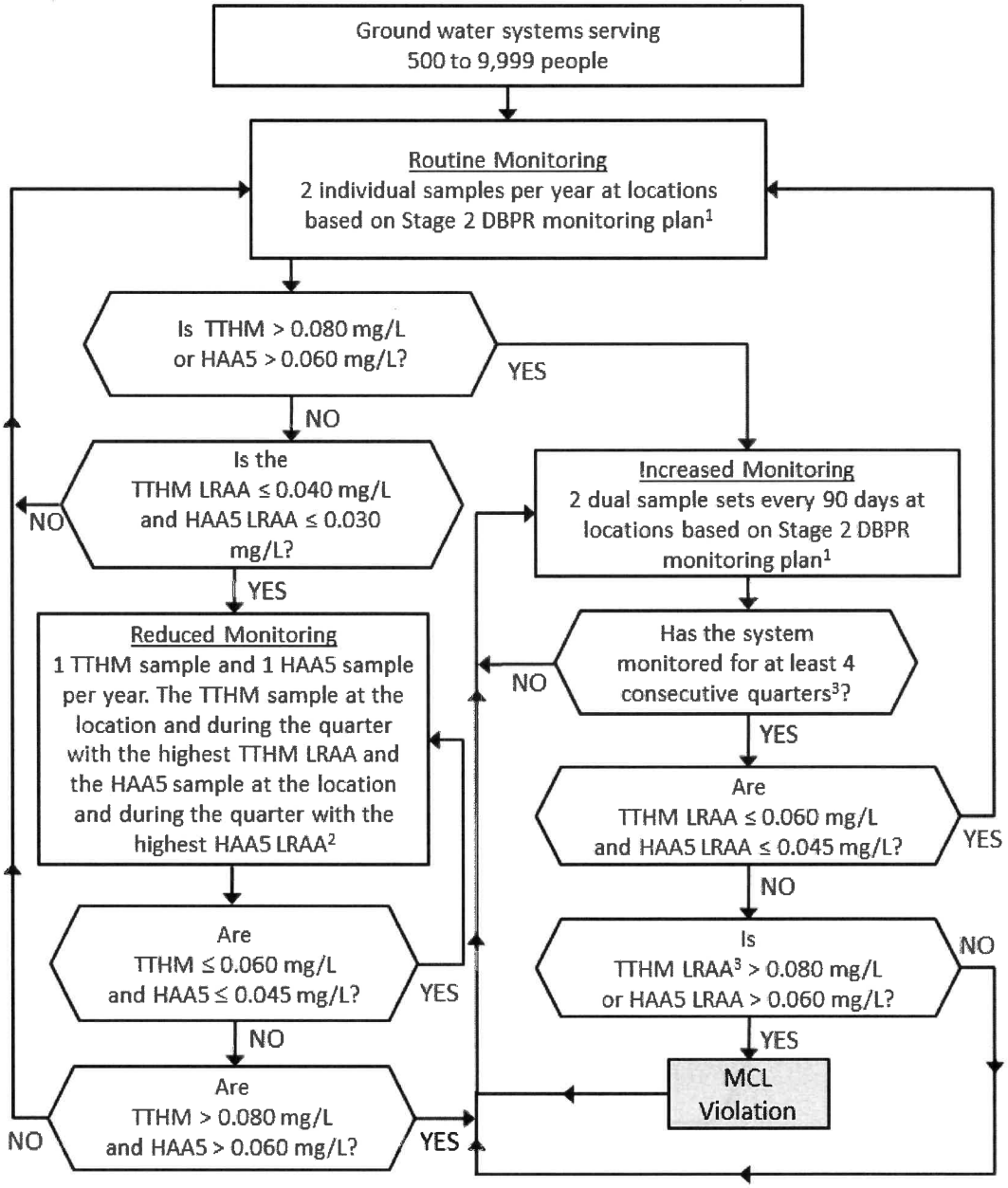
TTHM and HAA5 monitoring requirements for ground water systems that deliver water that has been treated with a disinfectant other than UV light and the largest system in the CDS serves 10,000 to 99,999 people



NOTES

1. Monitoring locations must be based on Stage 2 DBPR monitoring plan. See Attachment 1 for an explanation of the site selection protocol.
2. Systems must calculate the arithmetic average of results for each monitoring location, and an exceedance at any location is an MCL violation. If a PWS fails to complete 4 consecutive quarters of monitoring, compliance with the MCL for the last 4-quarter period must be based on the average of available data.

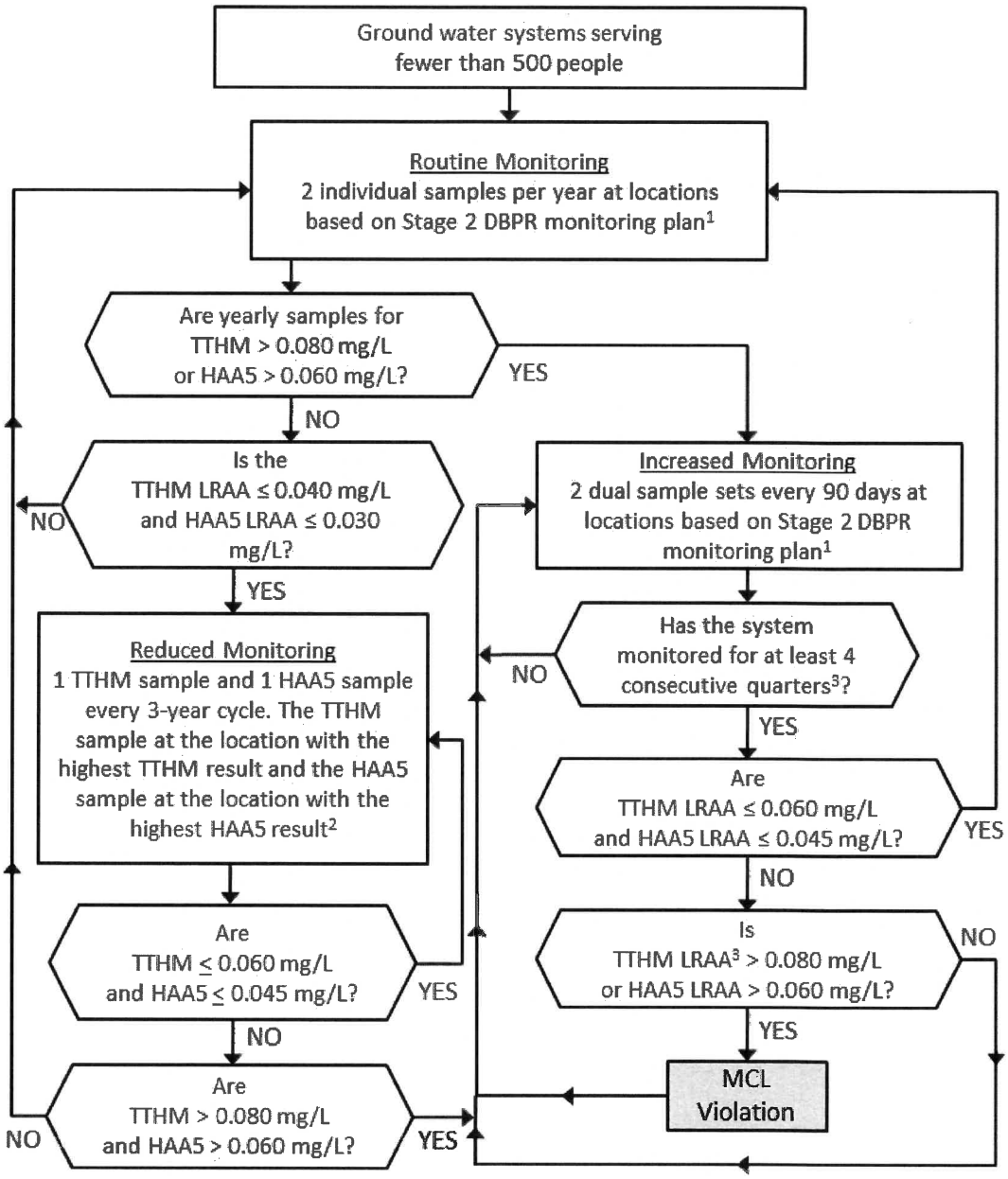
TTHM and HAA5 monitoring requirements for ground water systems that deliver water that has been treated with a disinfectant other than UV light and the largest system in the CDS serves 500 to 9,999 people



NOTES

1. Monitoring locations must be based on the Stage 2 DBPR monitoring plan. See Attachment 1 for an explanation of the site selection protocol.
2. One dual sample set per year if the highest TTHM and HAA5 measurements occurred in the same location and quarter.
3. If a PWS fails to complete 4 consecutive quarters of monitoring, compliance with the MCL for the last 4-quarter period must be based on the average of available data.

TTHM and HAA5 monitoring requirements for ground water systems that deliver water that has been treated with a disinfectant other than UV light and the largest system in the CDS serves fewer than 500 people



NOTES

1. Monitoring locations must be based on the Stage 2 DBPR monitoring plan. See Attachment 1 for an explanation of the site selection protocol.
2. One dual sample set per year if the highest TTHM and HAA5 measurements occurred in the same location and quarter.
3. If a PWS fails to complete 4 consecutive quarters of monitoring, compliance with the MCL for the last 4-quarter period must be based on the average of available data.

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Attachment 3: CWSs and NTNCWSs that deliver water that has been treated with chlorine or chloramines

Routine Monitoring

If you deliver water that has been treated with chlorine or chloramines, you must sample for chlorine and chloramines at the same time and location as your Revised Total Coliform Rule (RTCR) samples.

Reduced Monitoring

There is no reduced monitoring specifically allowed for chlorine and chloramines samples. Your chlorine and chloramines samples are tied to your RTCR routine and repeat samples.

Compliance

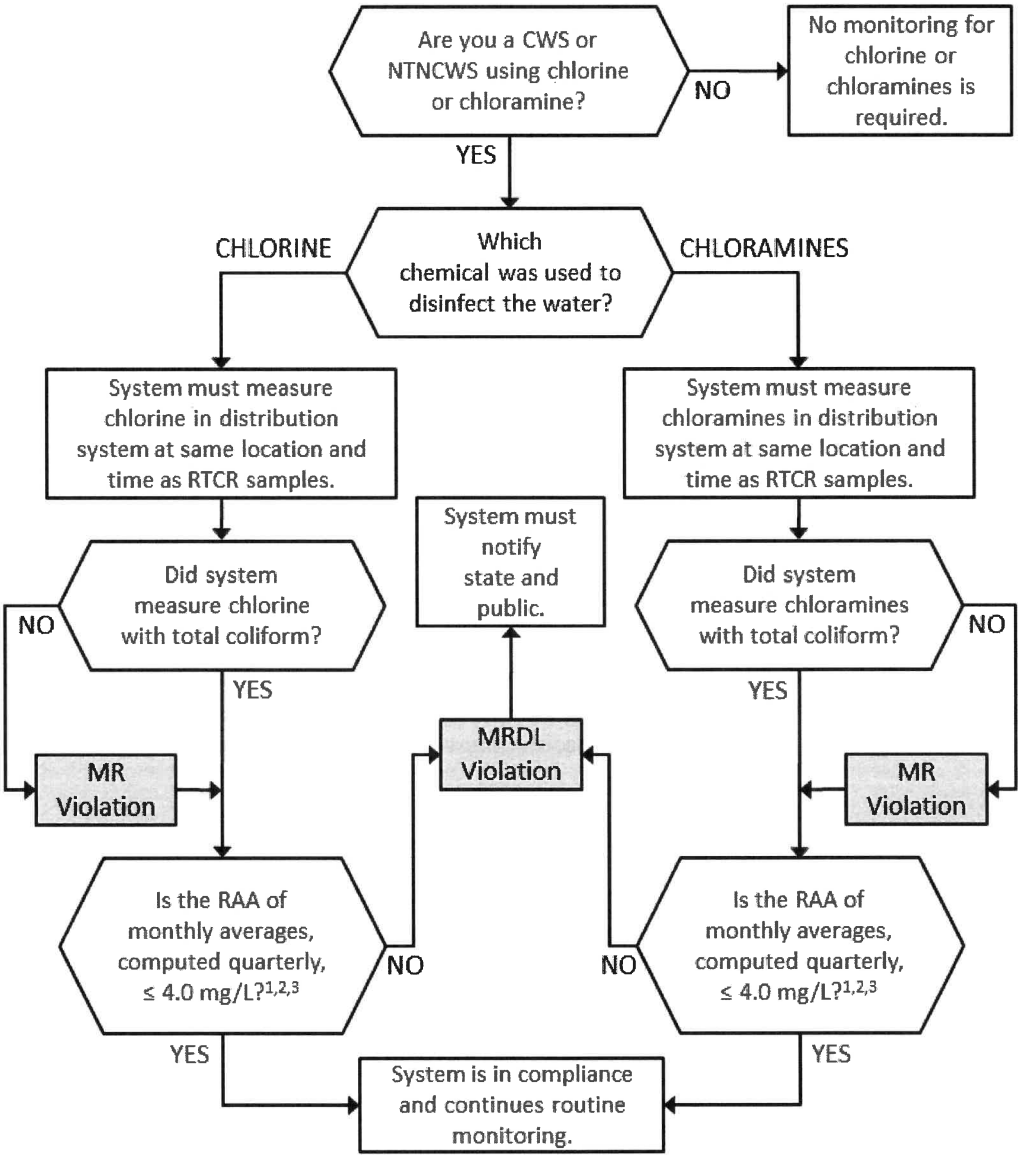
You must notify the public and report to the state if you are in violation. You must determine compliance with a RAA, computed quarterly, of monthly averages of all samples collected. If an annual arithmetic average of monthly averages covering any consecutive 4-quarter period exceeds the MRDL, then you are in violation of the MRDL. If you switch between chlorine and chloramines for residual disinfection during the year, you must determine compliance by including together all monitoring results for both chlorine and chloramines.

The MRDL for chlorine and chloramines is 4.0 mg/L. Notwithstanding the MRDL, systems may increase residual disinfectant levels of chlorine or chloramines in the distribution system to a level and for a time necessary to protect public health to address specific microbiological contamination problems.

Reporting

You must report to the state within 10 days after the end of each quarter during which samples were collected. You must report the number of samples taken during each month of last quarter, the monthly arithmetic average of all samples taken in each month and the RAA of all monthly averages for the last 12 months. You also must report whether a MRDL was exceeded.

Monitoring Requirements for Chlorine and Chloramines



NOTES

1. Notwithstanding the MRDLs for chlorine and chloramines, systems may increase residual disinfectant levels of chlorine or chloramines in the distribution system to a level and for a time necessary to protect public health to address specific microbiological contamination problems.
2. If system switches between use of chlorine and chloramines, compliance must be determined by including together all monitoring results of both chlorine and chloramines in calculating compliance.
3. The RAA is first calculated after first 12 months of monitoring.

Attachment 4: Systems that deliver water that has been treated with chlorine dioxide

Systems Adding Chlorine Dioxide

If you treat water with chlorine dioxide you must sample for chlorine dioxide as a residual disinfectant. All CWSs, NTNCWSs and TNCWSs that add chlorine dioxide, regardless of the purpose (for example, disinfection, oxidation, or maintenance of a residual), must monitor for chlorine dioxide. You must comply with the MRDL for chlorine dioxide, which is 0.8 mg/L.

Chlorine Dioxide Routine Monitoring

You must sample every day you use chlorine dioxide at the entry point to the distribution system. If any daily sample exceeds the MRDL, you must conduct increased monitoring.

Chlorine Dioxide Increased Monitoring

If any daily chlorine dioxide sample exceeds the MRDL, you must take three samples the following day. If you operate booster chlorination you must sample as close as possible to the first customer, at a location in the distribution system representing average residence time and as close as possible to the end of the distribution system. If you do not operate booster chlorination then all samples must be as close as possible to the first customer at intervals of at least 6 hours.

Chlorine Dioxide Reduced Monitoring

There is no reduced monitoring for the daily sampling of chlorine dioxide.

Chlorine Dioxide Compliance

You must notify the public and report to the state if you are in violation. There are acute and non-acute violations for chlorine dioxide monitoring. You have incurred an acute violation if any daily sample taken at entrance to the distribution system exceeds 0.8 mg/L, and on the following day one or more of the three samples taken in the distribution system exceeds 0.8 mg/L. You must take immediate corrective action to lower the level of chlorine dioxide below 0.8 mg/L, notify the public and report to the state. Failure to take samples in the distribution system following an exceedance of the MRDL at the entrance to the distribution system is also an acute violation.

If any two consecutive daily samples taken at entrance to distribution system exceed 0.8 mg/L, and all distribution system samples are below 0.8 mg/L, you have incurred a non-acute violation. The system must take immediate corrective action to lower the level of chlorine dioxide below 0.8 mg/L. Failure to take samples at the entrance to the distribution system following an exceedance of the MRDL is also a non-acute violation.

Chlorine Dioxide Reporting

You must report to the state within 10 days after the end of each quarter during which samples were collected.

You must report the dates, results and locations of chlorine dioxide samples taken during last quarter, whether a MRDL was exceeded and whether a MRDL was exceeded in any two consecutive daily samples. You must report any acute or non-acute violations.

CWSs and NTNCWSs Delivering Water Treated with Chlorine Dioxide

If you deliver water treated with chlorine dioxide, you must sample for chlorite as a contaminant. All CWSs and NTNCWSs that deliver water treated with chlorine dioxide must monitor for both chlorine dioxide and for the DBP, chlorite. You must comply with the MRDL for chlorine dioxide, which is 0.8 mg/L. In addition, you must comply with the MCL for chlorite, which is 1.0 mg/L. The requirements to sample for both chlorine dioxide and chlorite help to improve public health by reducing exposure to DBPs.

Chlorite Routine Monitoring

You must sample for chlorite every day you deliver water treated with chlorine dioxide at the entry point to the distribution system. If any daily sample exceeds 1.0 mg/L you must conduct increased monitoring.

Additionally, you must collect one 3-sample set per month. One sample must be taken from the location representative of average residence time in the distribution system, one sample from the location representing maximum residence time and one sample at the entry point to the distribution system.

Chlorite Increased Monitoring

If any daily sample exceeds 1.0 mg/L, you must take three samples the following day. You must sample as close as possible to the first customer, at a location representative of maximum residence time and at a location representative of average residence time in the distribution system.

Chlorite Reduced Monitoring

There is no reduced monitoring for the daily samples for chlorite.

If you qualify and your state allows, you may reduce monthly chlorite monitoring to one 3-sample set per quarter if no daily or monthly sample has exceeded the MCL and no additional monitoring has been required. The quarterly 3-sample set must be taken from a location near the first customer, a location representative of average residence time and a location representative of maximum residence time in distribution system.

Chlorite Compliance

You must notify the public and report to the state if you are in violation.

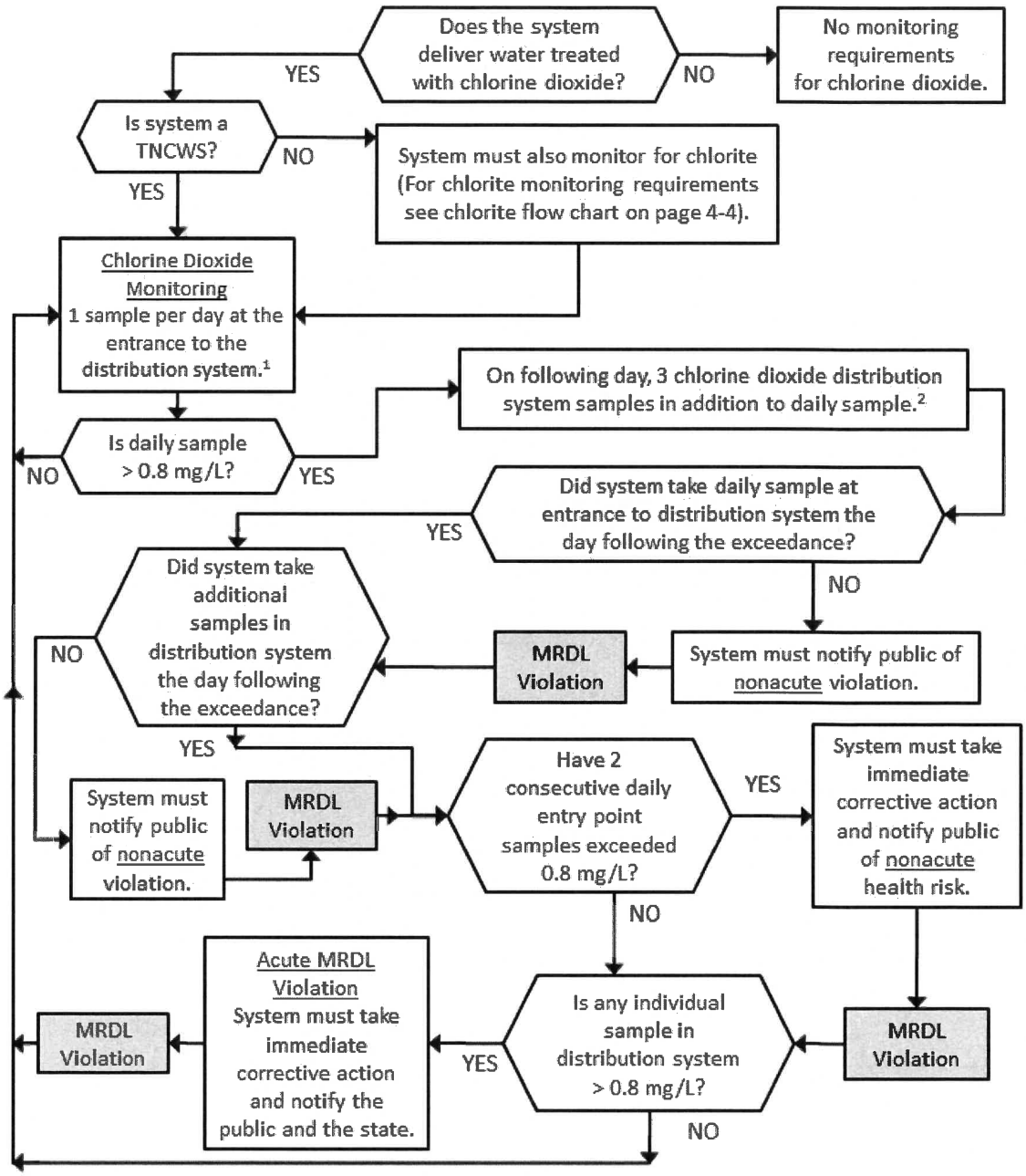
Compliance for the chlorite MCL is determined by an average of 3-sample sets. If the arithmetic average of any 3-sample set in the month exceeds the MCL, the system is in violation.

Chlorite Reporting

You must report to the state within 10 days after the end of each quarter during which samples were collected.

You must report the number of chlorite samples taken during the last 3 months, and the location, date and result of each sample taken during the last quarter. You must report the monthly arithmetic average of all samples taken in each 3-sample set taken, and you also must report whether the MCL was exceeded and how many times it was exceeded in the 3 months.

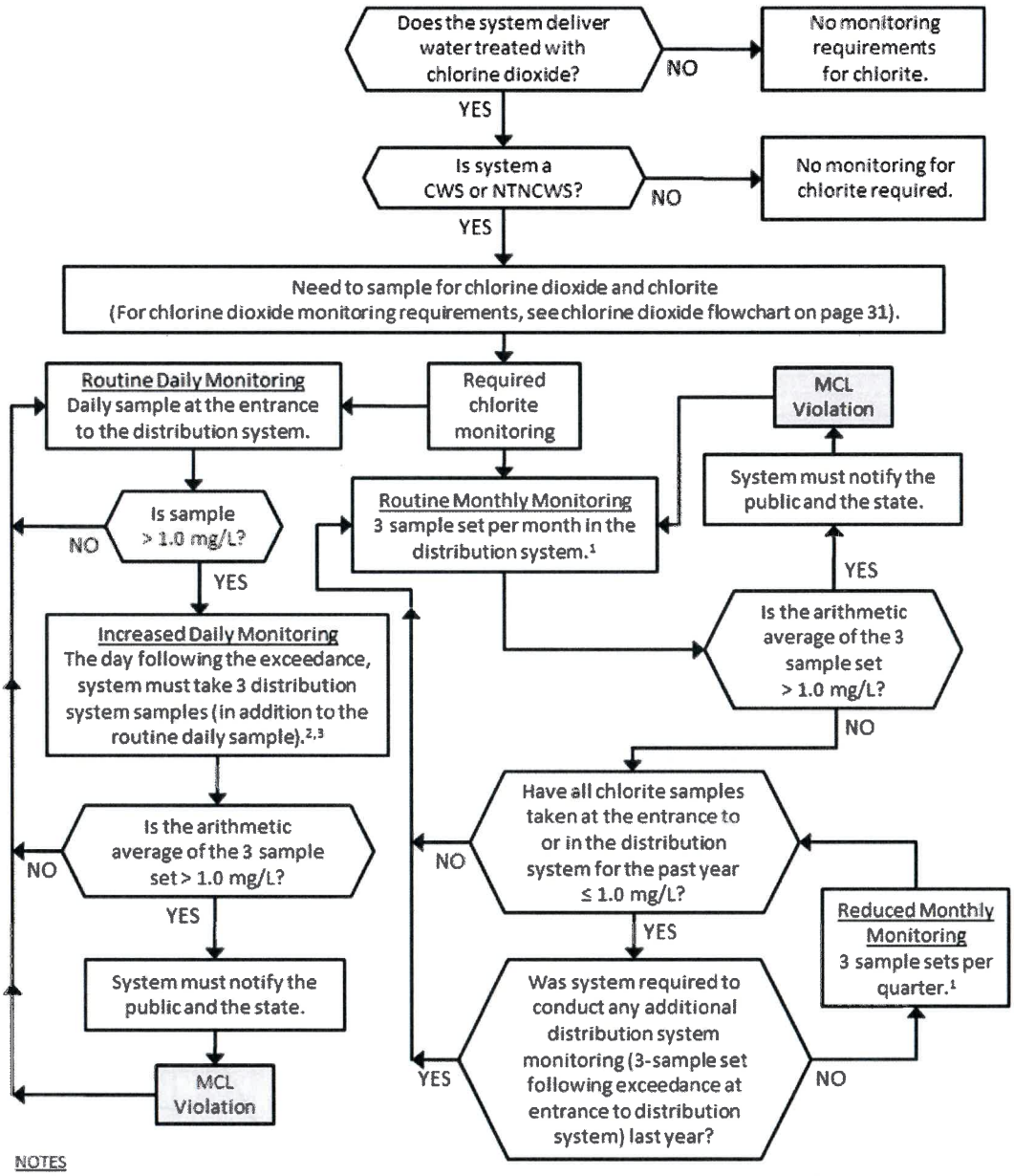
Chlorine Dioxide Monitoring Requirements for Systems Adding Chlorine Dioxide



NOTE

1. Sample taken every day that chlorine dioxide is used.
2. If chlorine dioxide, chloramines, or chlorine are used to maintain a disinfectant residual in the distribution system, and there are no disinfection addition points (i.e., no booster chlorination) after the entrance to the distribution system, the system must take 3 samples as close to the first customer as possible, at intervals of at least every 6 hours. If chlorine is used to maintain a disinfectant residual in the distribution system and there are one or more booster chlorination stations, the system must take one sample as close to the first customer as possible, one in a location representative of average residence time, and one as close to the end of the distribution system as possible.

Chlorite Monitoring Requirements for CWSs and NTCWSs Delivering Water Treated with Chlorine Dioxide



NOTES

1. The system must take one sample at each of the following locations: near the first customer, at a location representative of average residence time, and at a location reflecting maximum residence time in the distribution system.
2. The system must take one sample at each of the following locations: as close as possible to the first customer, at a location representative of average residence time, and at a location reflecting maximum residence time in the distribution system.
3. If the system has not performed the routine monthly sampling for chlorite, they can use this 3 sample set for their monthly chlorite samples.

Attachment 5: Systems that deliver water that has been treated with ozone

If you are CWS or NTNCWS that operates a treatment plant that uses ozone, you must monitor for the DBP bromate.

Routine Monitoring

You must collect one bromate sample per month per treatment plant at the entry point to the distribution system while the ozonation system is operating under normal conditions.

Reduced Monitoring

You may collect one bromate sample per quarter per treatment plant at the entry point to the distribution system.

If you qualify and your state allows, you may conduct reduced monitoring only if the RAA of your routine monitoring bromate results is less than or equal to 0.0025 mg/L.

Compliance

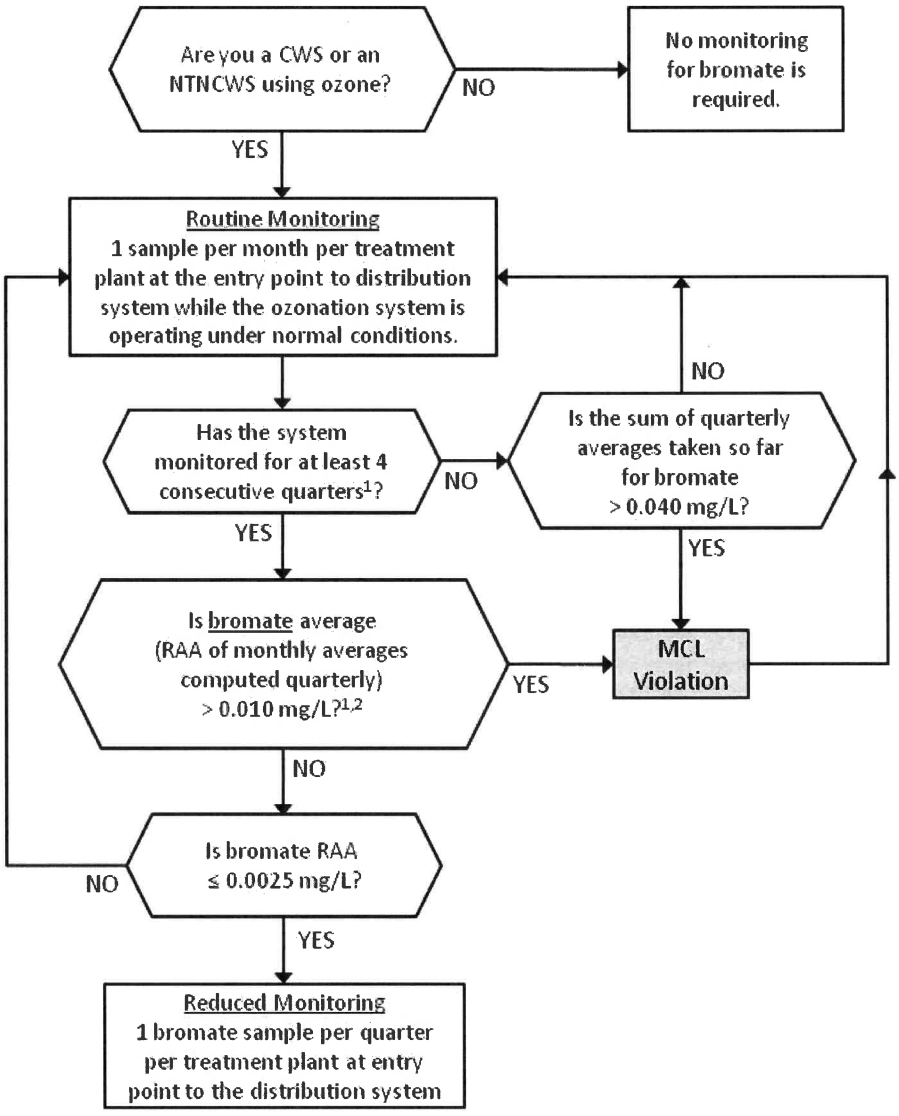
The MCL for bromate is 0.010 mg/L. You must notify the public and report to the state if you are in violation of the MCL. Bromate compliance is determined by a running annual arithmetic average, computed quarterly, of monthly samples (or average of all samples taken during the month if more than one sample was collected). If the average of monthly samples covering any consecutive 4-quarter period exceeds the MCL, the system is in violation.

If you fail to monitor, you are in violation of the monitoring requirements for each quarter that the monitoring result would have been used in the compliance calculation. All samples taken and analyzed under the provisions of your monitoring plan must be included in determining compliance, even if there are more than the minimum required. If during the first year of monitoring, any individual quarter's average will cause the RAA of that system to exceed the MCL, the system is out of compliance at the end of that quarter.

Reporting

You must report to the state within 10 days after the end of each quarter during which samples were collected. You must report the number of samples taken during last quarter, the location, date and result of each sample and the arithmetic average of monthly arithmetic averages of all samples taken in the last year. You also must report whether the MCL was exceeded.

Monitoring Requirements for Bromate for Systems Using Ozone



NOTES

1. If a PWS fails to complete 4 consecutive quarters of monitoring, compliance with the MCL for the last 4-quarter period must be based on the average of available data.
2. The average is based upon representative monthly bromide measurements for 1 year (in months where more than one sample is taken, use the average of all samples taken during the month).

Attachment 6: Subpart H systems that operate a conventional filtration treatment plant

If you operate a Subpart H system and operate a conventional treatment plant, then you must comply with TOC removal requirements.

Routine Monitoring

You must take one monthly paired TOC sample and one monthly alkalinity sample at the same time. The TOC paired sample includes one measurement from the source water prior to any treatment, and one measurement no later than the point of combined filter effluent turbidity monitoring and representative of filtered water. The alkalinity sample must be taken at the same location as the source water TOC sample.

Reduced Monitoring

If you qualify and your state allows, you may reduce monitoring to one paired TOC sample and one alkalinity sample at the same time per quarter, if you have an average treated water TOC less than 2.0 mg/L for 2 consecutive years, or less than 1.0 mg/L for 1 year. Reduced monitoring locations are the same as routine monitoring locations.

Compliance

There are different ways of determining compliance with the TOC removal requirement. Using the monitoring results you can determine TOC removal using enhanced coagulation or enhanced softening. The required TOC removal is listed in the table below.

Table 6.1 - Step 1 TOC – TOC Removal (3 by 3 Matrix)

Source Water TOC	Source Water Alkalinity, mg/L as CaCO3		
(mg/L)	0-60	> 60-120	>120
> 2.0 to 4.0	35.0%	25.0%	15.0%
> 4.0 to 8.0	45.0%	35.0%	25.0%
> 8.0	50.0%	40.0%	30.0%

You may also show you are in compliance with the TOC removal requirement by using one of the following alternative compliance criteria:

1. RAA of monthly source water TOC samples less than 2.0 mg/L.
2. RAA of monthly treated water TOC samples less than 2.0 mg/L.
3. RAA of source water TOC less than 4.0 mg/L, RAA of source water alkalinity greater than 60 mg/L, and either:
    a. TTHM RAA less than or equal to 0.040 mg/L and HAA5 RAA less than or equal to 0.030 mg/L; or
    b. The CWS or NTNCWS has made a "clear and irrevocable commitment" to installing technology to limit TTHM and HAA5 to those levels.
4. TTHM RAA less than or equal to 0.040 mg/L and HAA5 RAA less than or equal to 0.030 mg/L, and the CWS or NTNCWS uses only chlorine for primary disinfection and maintenance of a residual.
5. RAA of SUVA prior to any treatment less than or equal to 2.0 L/mg-m.

6. RAA of treated water SUVA less than or equal to 2.0 L/mg-m.
7. Softening systems only: Softening that results in a RAA of treated water alkalinity less than 60 mg/L (as calcium carbonate).
8. Softening systems only: Softening that results in a RAA for the removal of magnesium hardness (as calcium carbonate) of at least 10 mg/L.

Finally, if you cannot achieve compliance with TOC removal requirement using one of these two methods you should contact your state and discuss Step 2 TOC removal or a waiver.

Where the system's failure to monitor makes it impossible to determine compliance with the treatment technique, this failure to monitor will be treated as a monitoring violation for the entire period covered by the annual average. All samples taken under the provisions of the monitoring plan must be included in determining compliance, even if that number is greater than the minimum required.

Reporting

You must report to the state within 10 days after the end of each quarter during which samples were collected. You must report the number of paired samples taken during last quarter, the location, date and result of each paired sample and associated alkalinity taken during last quarter. You also must report whether system is in compliance with the enhanced coagulation or enhanced softening percent removal requirements for the last 4 quarters.

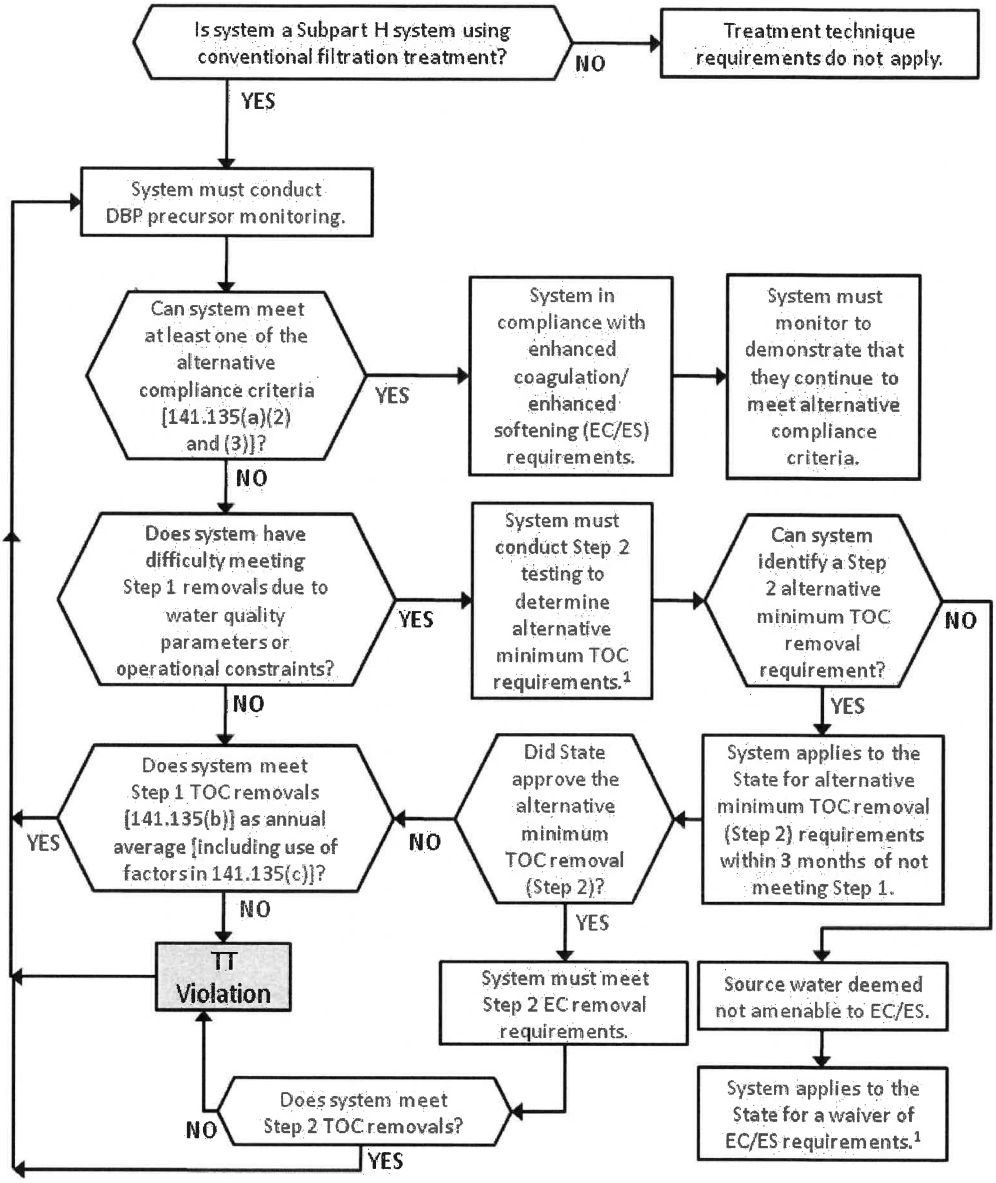
Systems using Step 1 or Step 2 enhanced coagulation or enhanced softening must report:

- For each month in the reporting period, the arithmetic average of the percent reduction of TOC for each paired sample and the required TOC percent removal.
- Calculations for determining compliance with TOC percent removal requirements.

Systems using an alternative compliance criterion must report:

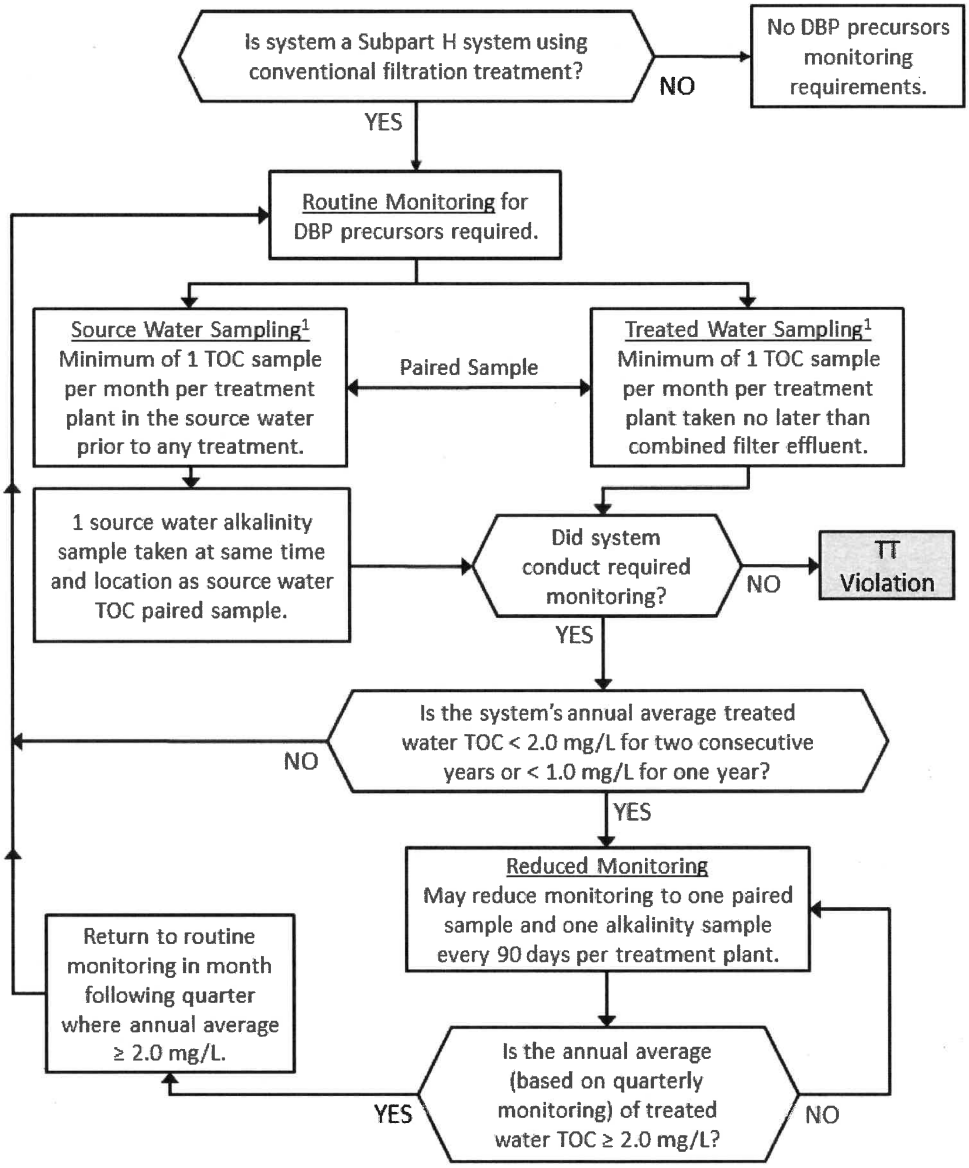
- RAA of source water SUVA or treated water SUVA if using this criterion for alternative compliance.
- RAA based on monthly average of source or treated water TOC if using this criterion for alternative compliance.
- RAA of source water alkalinity or treated water alkalinity if using this criterion for alternative compliance.
- RAA for both TTHM and HAA5 if using this criterion for alternative compliance.
- RAA of amount of magnesium hardness removal if using this criterion for alternative compliance.
- Whether system is in compliance with particular alternative compliance criterion.

Disinfection Byproducts Precursor Removal Treatment Technique



NOTE
1. Until the system receives a waiver from the state, they must meet Step 1 removals.

Monitoring Requirements for Disinfection Byproduct Precursors



NOTE

1. The source water and the treated water samples are referred to as paired samples and are to be taken simultaneously.

CHARLES TOWN UTILITY BOARD

TASK 05 SEWER MODEL

JANUARY 22, 2021

(DRAFT SUBMISSION)

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I. EXECUTIVE SUMMARY

This Report contains hydraulic model development, collection system hydraulic capacity analysis, assessment of existing conditions of pumping stations, and recommendations for rehabilitation and improvements. This modeling effort consisted of creating a skeletonized model of CTUB's collection system, using the CTUB's updated GIS information and data obtained from CTUB.

Average daily sewage flows were based on EDU counts that were redistributed across the model. Wet weather flows were developed based on available meter data and utilized as the base storm event. Predicted peak flows calculated by the model were utilized to determine sewer pipe design capacity.

The majority of the CTUB conveyance system appears to be adequately sized to convey the existing average daily sewer flows; however, during wet weather flow simulations, several sections of the Evitts Run interceptor were identified as being overloaded or having capacity concerns. Results of the sewer model also showed that the Park Line is experiencing capacity issues, which was validated by evidence of manhole surcharge. However temporary flow meter results from the Park Gravity Line were 60% lower than predicted by the model. Therefore, additional flow monitoring and field observations are recommended to confirm the accuracy of the model in this area.

Additional flow monitoring is recommended for several of the pump stations within CTUB's system to determine the accuracy of pump run times from operator logs and draw down tests. For example, flow results from Clarence, Demory, and Willow pump stations were conservative by 20% compared to the results predicted by the model. On the other hand, the results from the temporary flow monitoring upstream of the Wendy's Pump Station were higher than predicted by the model. As a result, CTUB is encouraged to install temporary flow meters upstream of several pump stations to collect more data to further validate the model.

The hydraulic capacity for the pump station evaluations was based on a review of data provided by CTUB, including GIS mapping, record drawings, operator logs, and pump station O&M manuals. Each pump station was evaluated with recommendations made for operational improvements.

Continual review, data collection and calibration of the hydraulic model will provide a tool for managing the collection and conveyance system. Thereby, developing a model that improves system evaluation during system growth and troubleshooting problems as they arise.

CHARLES TOWN UTILITY BOARD

TASK 05 SEWER MODEL

(DRAFT SUBMISSION)

II. INTRODUCTION

The Charles Town Utility Board (CTUB) has concerns that flows from recent wet weather and seasonal weather cycles, as well as current and future normal flows, cannot be collected, conveyed and treated because of inadequate hydraulic capacity in parts of the collection system. In addition, pumping stations and associated pipelines are old and may need to be rehabilitated or replaced. Focused studies, reports, and analyses have been completed in recent years but there is a need for a comprehensive review of the system to identify deficiencies and the prioritization of expansion and/or upgrades for capital improvement planning and budgeting.

RK&K is pleased to provide CTUB a comprehensive review of its collection system and pumping stations. The model includes gravity sewers, pump stations and force main sewer lines specified by CTUB. This *Sewer Model* contains hydraulic model development, collection system hydraulic capacity analysis, assessment of existing conditions of pumping stations, and recommendations for model improvements.

III. HYDRAULIC MODEL DEVELOPMENT

a. Creation of Existing Hydraulic Model

The modeling effort began with GIS feature data sets which were created from Record Drawings provided by CTUB. A model was developed that included approximately 30,000 LF of gravity sewer, 150 manholes, and 33,000 LF of force mains as specified by CTUB and shown in **Exhibit 1 in Appendix A**. The model also included eight (8) of the 47 pump stations distributed across CTUB's core system. These pump stations were composed of wet wells, pumps and force mains. Infrastructure dimensions and elevation data were checked for completeness. Items that were missing or questionable (e.g. adverse slopes, incoming inverts, etc.) were flagged to be reevaluated and updated. In addition, the dry weather diurnal flow pattern and peak wet weather patterns were developed to be used as a baseline for reevaluation and applicability.

b. Base/Average Daily Flows

Model loads were based on estimated Equivalent Dwelling Units (EDU) developed from residential counts and commercial flows provided by CTUB. CTUB has determined that one EDU is equivalent to 150 gallons per day (gpd). These developed average daily flows (ADF) were then distributed to the best extent possible through the model. Sanitary Load nodes, or locations where flow is added to the model, were identified based on the collection system layout. Load nodes were typically allocated to each minor basin, whereas larger collector systems were connected to the

conveyance sewers, or adjacent to pump stations. Collector systems, within the minor basins, were assigned to the closest connection node along the modeled sewer. **Exhibit 1 in Appendix A** and the Hydraulic Model Loading Table in **Appendix B** highlight the 27 load nodes that were used to distribute model flows.

c. Steady State Evaluation and Calibration

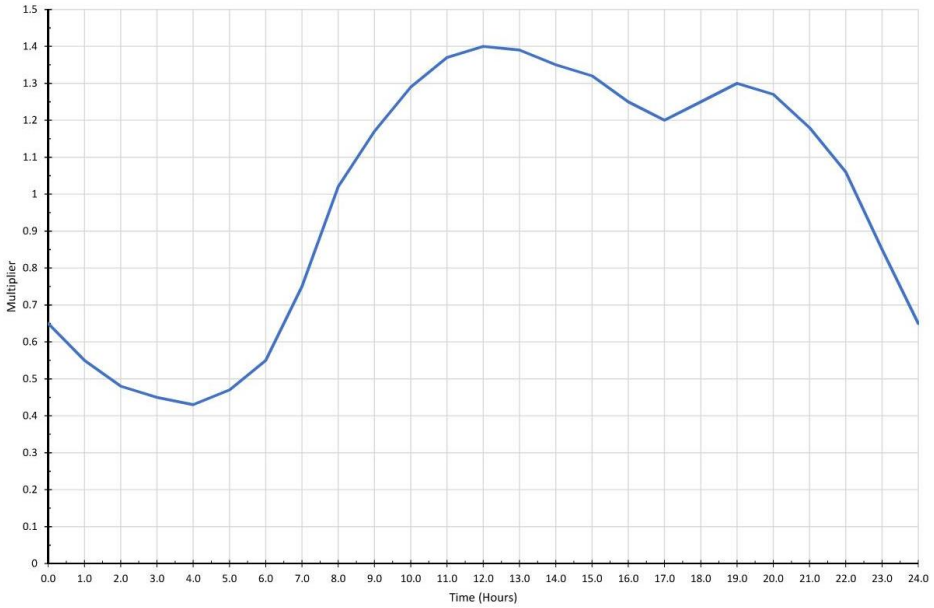
The model was assembled with the ADF loading and run under steady state conditions. The model was evaluated against the average flow at the CTUB Wastewater Treatment Plant, the eight (8) modeled pump stations, and three (3) different flow meters located across the collection system. Results are presented in **Appendix C**.

- Total Model Flows are within +/- 10% of the 2018 and 2019 ADF recorded at the WWTP. Confidence level in customer EDU count and value is high with the variation easily attributed to annual fluctuations in groundwater tables and local weather conditions.
- A month-long installation of a flow meter at CT-2 measured an average flow 3.4% higher than that predicted based on upstream EDUs. Model results along the Evitts Run (18”/24”) Interceptor should therefore be representative of actual conditions.
- The model predicts flows at the Demory Farms, Willow Spring and Clarence Drive pump stations to be approximately 20% higher than current meter readings. The model is predicting conservative results. It is therefore suggested to install temporary flow meters upstream of the pump stations to verify flow readings of the pump station flow meters.
- The model predicted flows from the Racetrack pump station are 50% greater than observed. However, observed values for the pump station are estimated based on logged pump run times and pump duty point. To increase confidence in the model, it is recommended to install flow meters upstream of the pump station to verify flows.
- A large difference in flow values was found in the area around the Wendy’s pump station. The flow meter installed at CT-362, upstream of the pump station, recorded flows approximately 90% greater than predicted by EDU counts. The Wendy’s station, on the other hand, had flows 45% lower than predicted. Additional flow monitoring in the area around the station to increase confidence in model results is recommended.
- The model predicted flow approximately 60% higher than recorded at the meter installed in CT-238. The flow meter results were 100,000 gallons per day lower than what was predicted by the model based on upstream EDU counts. It is recommended to install flow meters upstream of CT-235 where the force main from Clarence Drive PS discharges to verify the accuracy of the previous flow meter results.
- The model predicted flows to Samuel Street Pump Station that are 27% greater than observed. Additional flow monitoring in the Brownville Lane area above the station to increase confidence in model results is recommended.

d. Dynamic Diurnal Pattern - Base/Average Daily Flows

The developed model is a dynamic model and runs over an extended period. Therefore, a typical diurnal curve was generated based on average flowmeter data. The flows at each load point were applied to the curve so that the model can be evaluated over a simulated period of several days. **Figure 1** shows the curve that was used in the current model. The diurnal pattern has the peak hour flow of approximately 1.4 X ADF occurring at 12 noon.

Figure 1 – Average Daily Dry Weather Flow Typical Diurnal Pattern



e. Peak Wet Weather Flows

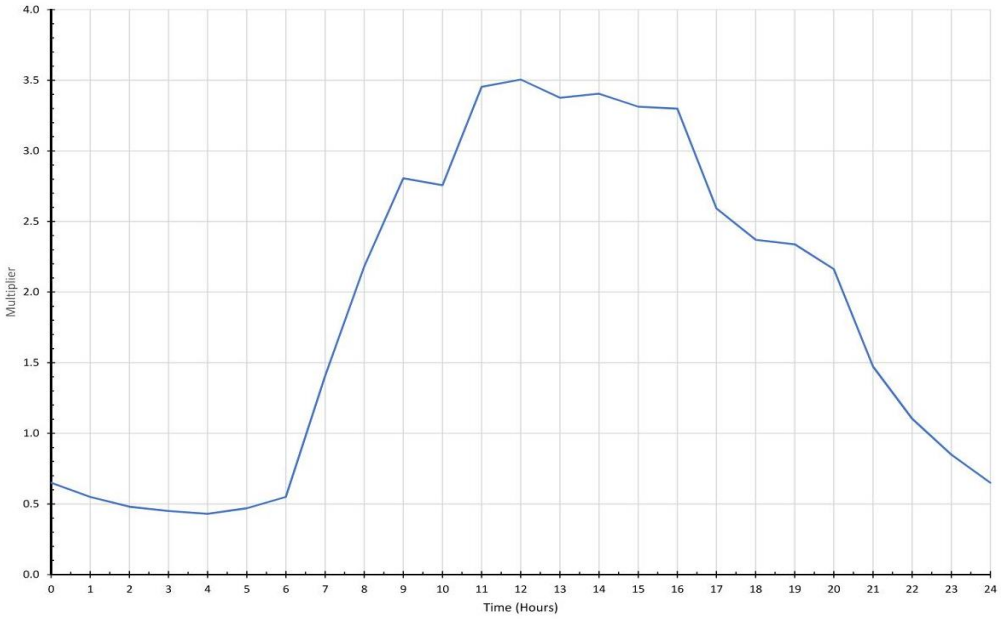
The severity of a wet weather event is defined by its duration and intensity. These events are often classified by their “return period” or frequency at which they statistically occur. When evaluating a conveyance system, a wet weather event with a 2-year to 5-year return period is often used. These are the type of events for which a sanitary sewer system must be capable of conveying sewage infiltration and inflow.

The storm pattern depicted in **Figure 2** is an approximation of the rain derived infiltration and inflow (RDII) expected from a 2-year to 5-year return period wet weather event with a duration of four hours. This approximation was derived from the synthetic storm available data from CTUB flow metering sites. This pattern has an approximate peaking factor of 3.5 times the ADF. It should be noted that CTUB’s service area is large, and it is difficult to obtain consistent system wide rainfall data with concurrent flowmeter data. A long duration flow monitoring program should be conducted to capture rain events and develop individual RDII hydrographs for the various drainage basins.

This peak wet weather flow (WWF) pattern was initially applied uniformly across all the sewer loads over an extended simulation period of 168 hours (7 days). This duration period was used to allow the flows in the model to reach a normal flow state

before the wet weather event occurred. The duration period also provided sufficient time after the wet weather event for the model to return to a normal flow state.

Figure 2 – Peak Wet Weather Flow Typical Loading Patterns



IV. COLLECTION SYSTEM HYDRAULIC CAPACITY

Predicted peak flow (PPF) calculated by the model was evaluated to determine utilization of design pipe capacity with the following criteria:

- PPF < 67% design capacity – Adequately sized
- 67% ≤ PPF < 80% - Pipe of concern; verify wet weather and future flows by implementing continuous real time flowmeter monitoring program.
- 80% ≤ PPF <100% - Pipe to be listed for redesign; utilize hydraulic modeling software to evaluate impacts of additional EDUs and wet weather events to ensure the system hydraulic capacity is not exceeded.
- PPF ≥ 100% - Pipe to be redesigned; implement moratorium on new sewer connections until hydraulic improvements to existing system are completed.

Severity of issue is dependent on whether these predicted flows are seen under dry weather or wet weather flow conditions. Numerical information for the hydraulic grade line (HGL), flow, and capacity of each conduit and associated structure (Node) are the basis of the information displayed in **Exhibit 2** and **Exhibit 3**, and can be found in **Appendices D and E**.

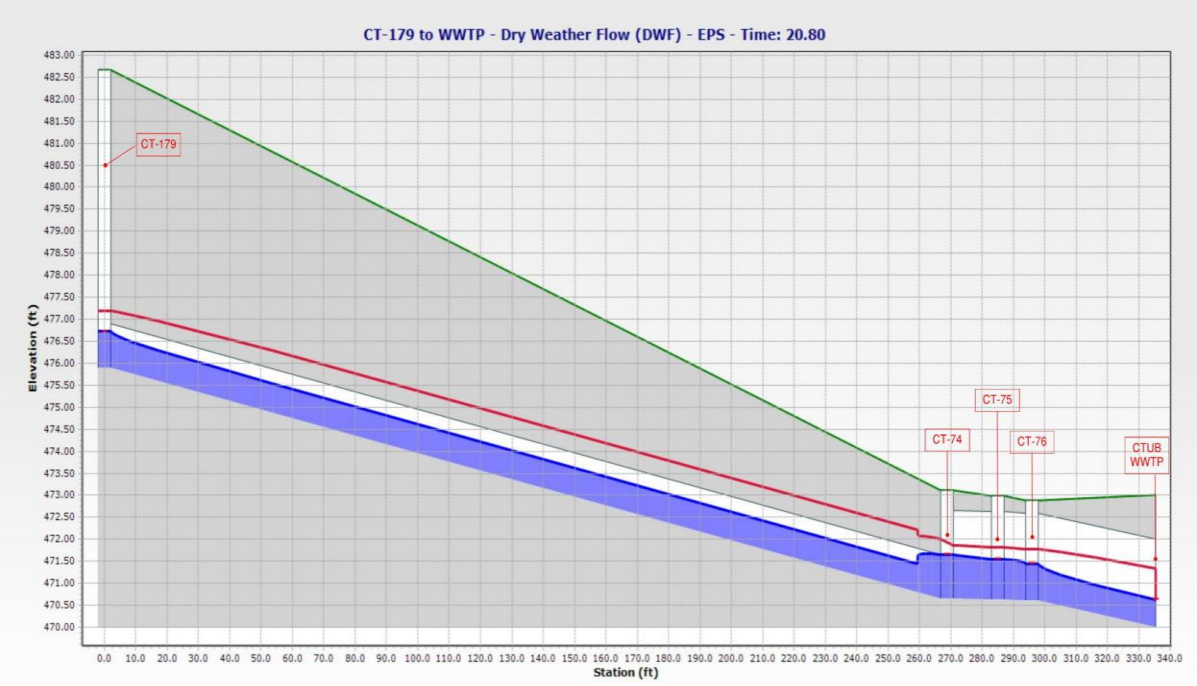
a. Current (2020) Conditions Model

Current Average Daily Dry Weather Flow/Peak Hour Flow

The majority of the CTUB conveyance system appears to be adequately sized to convey the existing dry weather sewer loading. One area along Evitts Run was identified as an area of concern. See **Exhibit 2** for a map of the predictions.

- Evitts Run Interceptor - Conduit form CT-179 to CT-74 upstream of WWTP. Predicted flows greater than 75% of capacity and a surcharged manhole CT-74. Pipes have a 24" and 12" diameter. As shown in **Figure 3**, Pipes from GIS have the same downstream invert resulting in a hydraulic jump due to a backwater condition. Usually, the smaller diameter branch pipe will share crown elevations with the main interceptor to alleviate this condition.

Figure 3 – Hydraulic Profile – CT-179 to WWTP - DWF



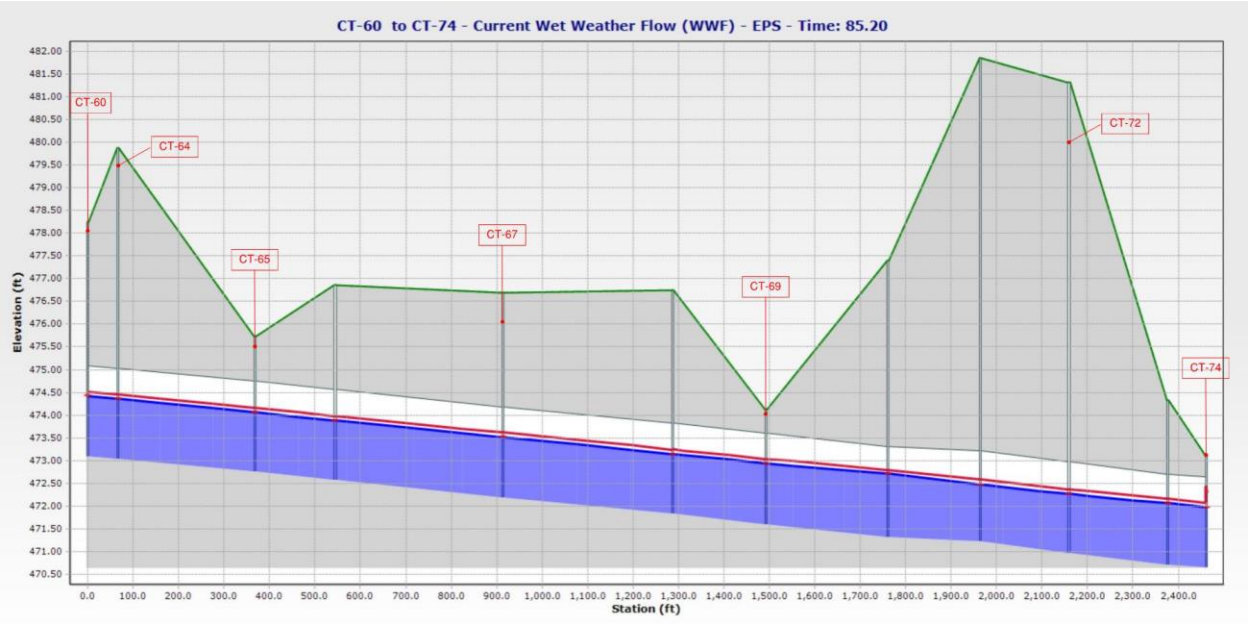
Current Peak Wet Weather Flow

During the wet weather flow simulations several additional interceptors were identified as having capacity concerns. In addition to the 24" Evitts Run Interceptor noted in the ADF model, additional sections of the Evitts Run Interceptor as well as portions of the Ranson sewer system were determined to be capacity deficient. Refer to **Exhibit 3** for a map of the predictions and **Appendix D or E** for a detailed listing of overflowing or surcharged manholes for the Current Wet Weather Flows.

- Evitts Run Interceptor, Charles Town, minor basin CT-64 has a predicted flow of between 67% and 80% of capacity for the majority of segments downstream to MH CT-67 and >100% for the flat slope segments between MHs CT-70 and

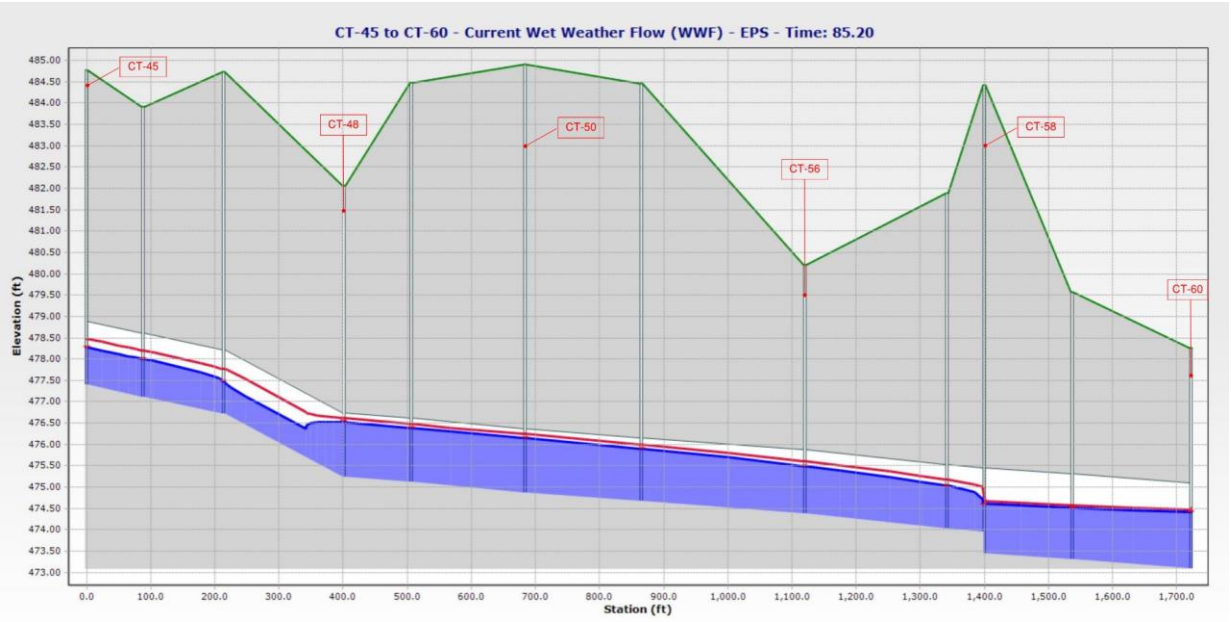
CT-71. An elevated HGL is predicted throughout the minor basin but the only surcharge occurs at MH CT-74. See **Figure 4.**

Figure 4 – Hydraulic Profile – CT-60 to CT-74 - WWF



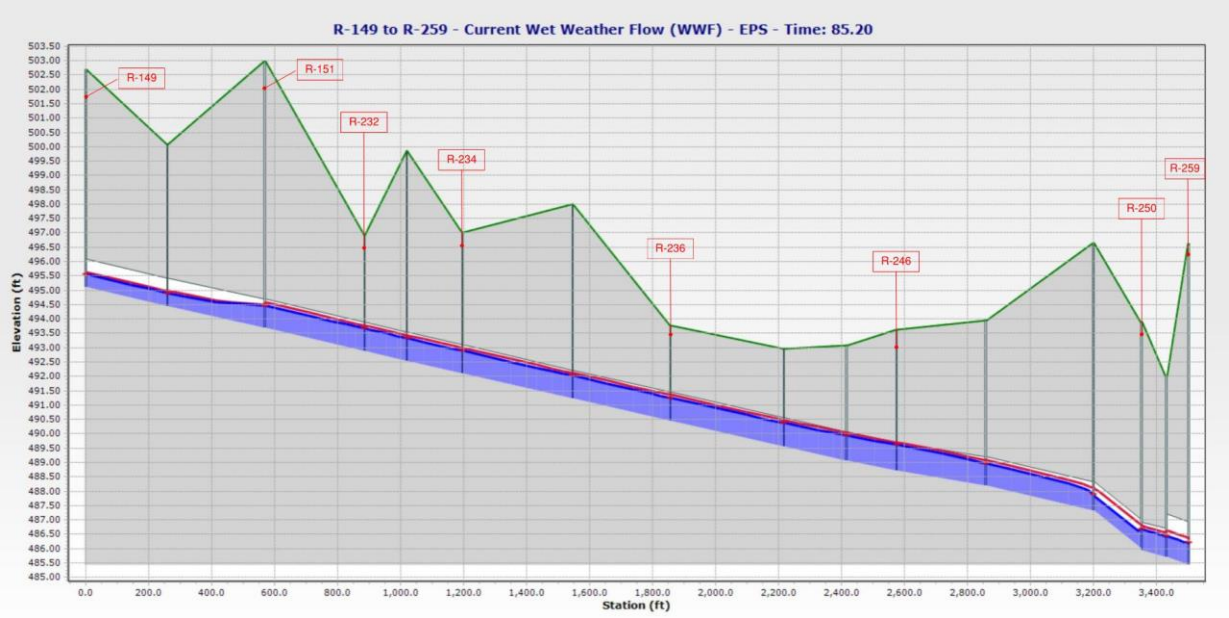
- The Evitts Run Interceptor, Charles Town, minor basin CT-423 has a flow capacity utilization >100% from MH CT-49 to CT-56 and one segment downstream of MH CT- 57. Additionally, there is a segment of pipe, downstream of MH CT-56 between 80% and 100% capacity. MHs show elevated HGLs but are not surcharged. See **Figure 5.**

Figure 5 – Hydraulic Profile –CT-45 to CT-60 – WWF



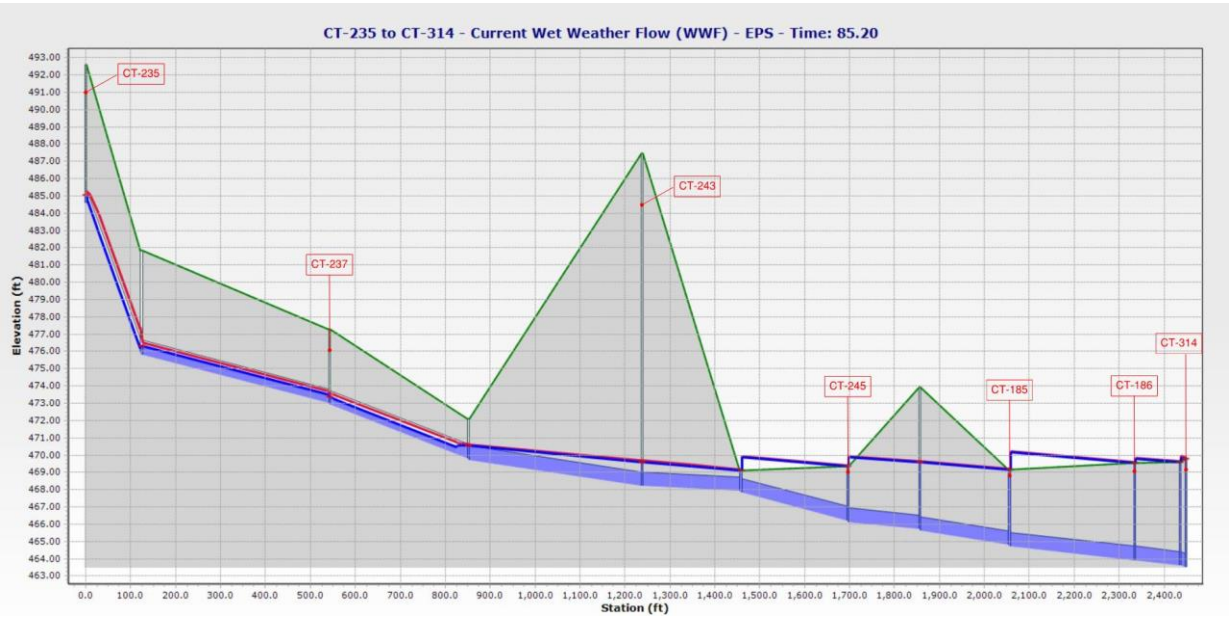
- The Ranson, minor basin R-151, has a flow capacity utilization between 80% and 100% from MH R-151 and R-249 and shows >100% for two segments downstream of MH R-242. MHs show elevated HGLs but are not surcharged. See **Figure 6.**

Figure 6 – Hydraulic Profile – R-149 to R-259 – WWF



- The Park Interceptor, Charles Town, minor basin CT-185 Park Interceptor shows capacity restrictions downstream of MH CT-238. Peak flows exceed the capacity of the downstream segments. Several manholes along this interceptor are predicted to be overflowing or surcharged. See **Figure 7.**

Figure 7 – Hydraulic Profile –CT-235 to CT-314 – WWF



V. PUMP STATION ANALYSIS

Throughout the report, 150 gallons/day per unit is used to calculate flows. This value is from the residential usage equivalents for capacity improvements fees section in CTUB's Sewer Tariff dated February 3, 2020. Information regarding pump stations and customer counts is from GIS mapping, record drawings, operator logs, and pump station O&M manuals provided by CTUB, which were used as the basis of the evaluation and contingent on the accuracy of the information provided.

Racetrack (3-6)

The Racetrack Pump Station currently runs an average of 1.2 hours per day and has a current available peaking factor of 20. Analysis indicates that the pump station is currently operating below capacity, however results of the hydraulic model indicate calculated flows based on pump run time may not be accurate and that flow monitoring should be conducted. See **Appendix F** for more information.

Pump Model	Myers 4VHX150M4-23 8,75" Impeller
No. of Pumps	2
Duty Point	250 GPM @ 67' TDH
2020 Avg. Hours/Day	1.2
2020 Max. Hours/Day	2.1
Wet Well Dim.	6' Diam. x 16'
Monitoring System	Omni
Force Main Size	6"

Pump Flow Rate: 250 GPM
Avg. Current Run Time: 1.2 hrs/day
Max. Current Run Time: 2.1 hrs/day

Avg. Current Daily Flow: (1.2 hrs/day) x (250 GPM) x (60 min./hr.) = 18,000 GPD
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (2.1 hrs/day) / (1.2 hrs/day) = 1.75
Current Available Peak Factor: (24 hrs) / (1.2 hrs) = 20

Breckenridge (3-7)

The Breckenridge Pump Station currently runs an average of 4.6 hours per day and has a current available peaking factor of 5.21. Alternate Main Line Agreements exist with Aspen Greens for 200 proposed units and with Beallair Subdivision. See **Appendix G** for more information. As stated in the RK&K Task 09 Beallair Downstream Capacity Report:

"RK&K's conclusion is that CTUB's existing system, including the Beallair Pump Station, the Breckenridge Subdivision Gravity Sewer, and the Breckenridge Pump Station can accommodate the additional flow from the previously approved Phases 3-5 and the proposed 200 units in Aspen Greens at this time. Therefore, it is RK&K's recommendation that CTUB can approve Piedmont Design Group's request for sewer service for the previously approved Beallair Phases 3-5 as a new pump station and sewer line are not necessary to serve Phases 3-5 requested by the Piedmont Design Group, LLC.

JCPSD had previously approved AMLEAs for Phases 1-5 for Beallair and 200 Aspen Greens. The analysis above confirms that there is adequate capacity in the system for the previously approved phases, however, additional requests such as Phase 6 may require pump station or pump modifications. In order to maintain a peaking factor closer to 4.0 for future unapproved development, the pumps at the Breckenridge Pump Station will need to be modified or replaced to increase pumping capacity. The existing 8" force main from Breckenridge will be able to accommodate flow from larger pumps. RK&K recommends that the development and the run times at the Breckenridge Pump Station continue to be monitored."

Pump Model	Myers 4VC300M4-43 10" Impeller
No. of Pumps	2
Duty Point	600 GPM @ 86.64' TDH
2020 Avg. Hours/Day	4.6
2020 Max. Hours/Day	10.4
Wet Well Dim.	8' Diam. X 22'4"
Monitoring System	Omni
Force Main Size	8"

Pump Flow Rate: 600 GPM
Avg. Current Run Time: 4.6 hrs/day
Max. Current Run Time: 10.4 hrs/day

Avg. Current Daily Flow: (4.6 hrs/day) x (600 GPM) x (60 min./hr.) = 165,600 GPD
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (10.4 hrs/day) / (4.6 hrs/day) = 2.26
Current Available Peak Factor: (24 hrs) / (4.6 hrs) = 5.21

Job Corps (3-8)

The Job Corps Pump Station currently runs an average of 0.9 hours a day and has a current available peaking factor of 26.7. Analysis indicates that the pump station is currently operating below capacity. See **Appendix H** for more information.

Pump Model	Flygt CP3152
No. of Pumps	2
Duty Point	80 GPM @ 117' TDH
2020 Avg. Hours/Day	0.9
2020 Max. Hours/Day	4.1
Wet Well Dim.	6' Diam. X 11'5"
Monitoring System	Omni
Force Main Size	4"

Pump Flow Rate: 80 GPM
Avg. Current Run Time: 0.9 hrs/day
Max. Current Run Time: 4.1 hrs/day

Avg. Current Daily Flow: (0.9 hrs/day) x (80 GPM) x (60 min./hr.) = 4,320 GPD
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (4.1 hrs/day) / (0.9 hrs/day) = 4.6
Current Available Peak Factor: (24 hrs) / (0.9 hrs) = 26.7

Jefferson High School (3-9)

The Jefferson High School Pump Station currently runs an average of 1.1 hours per day and has a current available peaking factor of 21.82. Analysis indicates that the Pump Station is operating below capacity. See **Appendix I** for more information.

Pump Model	Flygt CP3152
No. of Pumps	2
Duty Point	180 GPM @ 103' TDH
2020 Avg. Hours/Day	1.1
2020 Max. Hours/Day	3.1
Wet Well Dim.	6' Diam x 18'5"
Monitoring System	Omni
Force Main Size	6"

Pump Flow Rate: 180 GPM
Avg. Current Run Time: 1.1 hrs/day
Max. Current Run Time: 3.1 hrs/day

Avg. Current Daily Flow: (1.1 hrs/day) x (180 GPM) x (60 min./hr.) = 11,880 GPD
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (3.1 hrs/day) / (1.1 hrs/day) = 2.82
Current Available Peak Factor: (24 hrs) / (1.1 hrs) = 21.82

Briar Run I (3-10)

The Briar Run I Pump Station currently runs an average of 0.8 hours per day and has a current available peaking factor of 30. Analysis indicates that the Pump Station is operating below capacity. See **Appendix J** for more information.

Pump Model	Myers 4R-3BHP 6.5" Impeller
No. of Pumps	2
Duty Point	89 GPM @ 35' TDH
2020 Avg. Hours/Day	0.8
2020 Max. Hours/Day	1.2
Wet Well Dim.	5' Diam. X 16'
Monitoring System	Omni
Force Main Size	4"

Pump Flow Rate: 89 GPM
Avg. Current Run Time: 0.8 hrs/day
Max. Current Run Time: 1.2 hrs/day

Avg. Current Daily Flow: (0.8 hrs/day) x (89 GPM) x (60 min./hr.) = 4,272 GPD
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (1.2 hrs/day) / (0.8 hrs/day) = 1.50
Current Available Peak Factor: (24 hrs) / (0.8 hrs) = 30

Briar Run II (3-11)

The Briar Run II Pump Station currently runs an average of 5.2 hours per day and has a current available peaking factor of 4.62. Analysis indicates that the Pump Station is currently operating below capacity, however the capacity should be reevaluated if future development is proposed. See **Appendix K** for more information.

Pump Model	Myers 4R-3BHP 6.5" Impeller
No. of Pumps	2
Duty Point	113 GPM @ 33' TDH
2020 Avg. Hours/Day	5.2
2020 Max. Hours/Day	9.1
Wet Well Dim.	5' Diam. X 16'
Monitoring System	Omni
Force Main Size	4"

Pump Flow Rate: 113 GPM
Avg. Current Run Time: 5.2 hrs/day
Max. Current Run Time: 9.1 hrs/day

Avg. Current Daily Flow: (5.2 hrs/day) x (113 GPM) x (60 min./hr.) = 35,256 GPD
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (9.1 hrs/day) / (5.2 hrs/day) = 1.75
Current Available Peak Factor: (24 hrs) / (5.2 hrs) = 4.62

Beallair (3-13)

The Beallair Pump Station currently runs an average of 1.3 hours per day and has a current available peaking factor of 18.46. Analysis indicates that the Pump Station is currently operating below capacity. See **Appendix L** for more information.

RK&K Task 08 Beallair Downstream Capacity evaluated the capacity of the Beallair Pump Station with the addition of units in the Beallair Subdivision. The report noted:

"There are currently 111 units constructed in the Beallair subdivision, leading to a peak flow at the Beallair Pump Station of approximately 47 GPM. According to the Piedmont Design Group, LLC request, 304 units were approved in the plan, leading to a peak flow of approximately 127 GPM, which is within the pump's design rate of 204 GPM. The addition of 193 units will increase the pump station's average run time to 3.7 hours/day and peak run time to 14.8 hours/day, assuming a 4.0 peaking factor, which indicates that the station would still be operating below capacity. Therefore, the Beallair Pump Station can handle the flow from Phases 3-6 with no changes made to the pump station.

Additional capacity for the planned 132 units within Phase 6 has been requested. The additional 132 customers would increase the total number of housing units within the subdivision to 436, leading to a peak flow of approximately 182 GPM, which is within the pump's design rate of 204 GPM. The addition of 132 units will increase the pump station's average run time to 5.3 hours/day and peak run time to 21.2 hours/day with a 4.0 peaking factor, which indicates that the station would still be operating below capacity. Therefore, the Beallair Pump Station can handle the flow from the additional 132 units in Phase 6 with no changes made to the pump station."

Pump Model	Myers 4VE150M4
No. of Pumps	2
Duty Point	204 GPM @ 104' TDH
2020 Avg. Hours/Day	1.3
2020 Max. Hours/Day	3.0
Wet Well Dim.	6' Diam. X 24'
Monitoring System	Omni
Force Main Size	6"

Pump Flow Rate: 204 GPM
Avg. Current Run Time: 1.3 hrs/day
Max. Current Run Time: 3.0 hrs/day

Avg. Current Daily Flow: (1.3 hrs/day) x (204 GPM) x (60 min./hr.) = 15,912 GPD
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (3.0 hrs/day) / (1.3 hrs/day) = 2.31
Current Available Peak Factor: (24 hrs) / (1.3 hrs) = 18.46

Wendy's (4-2)

The Wendy's Pump Station currently runs an average of 1.7 hours per day and has a current available peaking factor of 14.12. Analysis indicates that the pump station is currently operating below capacity, however results of the hydraulic model indicate calculated flows based on pump run time may not be accurate and that flow monitoring should be conducted. See **Appendix M** for more information.

Pump Model	Myers 4VCX300-M4-23 10.25" Impeller
No. of Pumps	2
Duty Point	410 GPM @ 99' TDH
2020 Avg. Hours/Day	1.7
2020 Max. Hours/Day	2.4
Wet Well Dim.	6' Diam. X 24'
Monitoring System	Omni
Force Main Size	6"

Pump Flow Rate: 410 GPM
Avg. Current Run Time: 1.7 hrs/day
Max. Current Run Time: 2.4 hrs/day

Avg. Current Daily Flow: (1.7 hrs/day) x (410 GPM) x (60 min./hr.) = 41,820 GPD
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (2.4 hrs/day) / (1.7 hrs/day) = 1.41
Current Available Peak Factor: (24 hrs) / (1.7 hrs) = 14.12

Greenfield

The Greenfield Pump Station currently runs an average of 6.2 hours per day and has a current available peaking factor of 3.87. Analysis indicates that the system experiences a low amount of inflow and infiltration. Although the system has an available peaking factor less than four, the system is still operating below capacity. If future development is proposed in the service area, the capacity should be reevaluated. See **Appendix N** for more information.

Pump Model	Myers WGX75H-23-35
No. of Pumps	2
Duty Point	103 GPM @ 91' TDH
2020 Avg. Hours/Day	6.2
2020 Max. Hours/Day	11.2
Wet Well Dim.	5' Diam. X 9'5"
Monitoring System	Omni
Force Main Size	4"

Pump Flow Rate: 103 GPM
Avg. Current Run Time: 6.2 hrs/day
Max. Current Run Time: 11.2 hrs/day

Avg. Current Daily Flow: (6.2 hrs/day) x (103 GPM) x (60 min./hr.) = 38,316 GPD
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (11.2 hrs/day) / (6.2 hrs/day) = 1.81
Current Available Peak Factor: (24 hrs) / (6.2 hrs) = 3.87

Burr Park East (5-1)

The Burr Park East Pump Station currently runs an average of 1.9 hours per day and has a current available peak factor of 12.63. Analysis indicates that the pump station is operating below capacity. See **Appendix O** for more information.

Pump Model	Myers 4VC200M4-23
No. of Pumps	2
Duty Point	265 GPM @ 98' TDH
2020 Avg. Hours/Day	1.9
2020 Max. Hours/Day	3.4
Wet Well Dim.	8' Diam. X 18'6"
Monitoring System	Omni
Force Main Size	6"

Pump Flow Rate: 265 GPM
Avg. Current Run Time: 1.9 hrs/day
Max. Current Run Time: 3.4 hrs/day

Avg. Current Daily Flow: (1.9 hrs/day) x (265 GPM) x (60 min./hr.) = 30,210 GPD
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (3.4 hrs/day) / (1.9 hrs/day) = 1.79
Current Available Peak Factor: (24 hrs) / (1.9 hrs) = 12.63

Burr West (5-2)

The Burr West Pump Station currently runs an average of 0.4 hours per day and a maximum of 0.6 hours per day. An O&M Manual for the Burr West Pump Station was not available, and the model and duty point of the pumps are unknown. Based on the low run times, the current available peak factor is 60, which indicates that the pumps are operating below capacity. See **Appendix P** for more information.

Pump Model	Myers 4WHV30M4-23
No. of Pumps	2
Duty Point	unknown
2020 Avg. Hours/Day	0.4
2020 Max. Hours/Day	0.6
Wet Well Dim.	6’ Diam. X 15’9”
Monitoring System	Omni
Force Main Size	4”

Pump Flow Rate: unknown
Avg. Current Run Time: 0.4 hrs/day
Max. Current Run Time: 0.6 hrs/day

Avg. Current Daily Flow: unknown
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (0.6 hrs/day) / (0.4 hrs/day) = 1.50
Current Available Peak Factor: (24 hrs) / (0.4 hrs) = 60

Burr Royal (5-3)

The Burr Royal Pump Station currently runs an average of 0.4 hours per day and has a current available peak factor of 60. Analysis indicates that the pumps are operating below capacity. See **Appendix Q** for more information.

Pump Model	HOMA AMX434-235/13P/C
No. of Pumps	2
Duty Point	200 GPM @ 68' TDH
2020 Avg. Hours/Day	0.4
2020 Max. Hours/Day	0.9
Wet Well Dim.	8' Diam. X 14'
Monitoring System	Omni
Force Main Size	4"

Pump Flow Rate: 200 GPM
Avg. Current Run Time: 0.4 hrs/day
Max. Current Run Time: 0.9 hrs/day

Avg. Current Daily Flow: (0.4 hrs/day) x (200 GPM) x (60 min./hr.) = 4,800 GPD
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (0.9 hrs/day) / (0.4 hrs/day) = 2.25
Current Available Peak Factor: (24 hrs) / (0.4 hrs) = 60

Samuel Street (SS)

The Samuel Street Pump Station currently runs an average of 4.5 hours per day and has a current available peaking factor of 5.33. Analysis indicates that the pump station is operating below capacity. See **Appendix R** for more information. In addition, results of the hydraulic model indicate calculated flows based on pump run time may not be accurate and that flow monitoring should be conducted.

Pump Model	Flygt CP3152.181
No. of Pumps	2
Duty Point	1,005 GPM @ 49.9' TDH
2020 Avg. Hours/Day	4.5
2020 Max. Hours/Day	7.1
Wet Well Dim.	12' Diam. X 20'
Monitoring System	Mission
Force Main Size	10"

Pump Flow Rate: 1,005 GPM
Avg. Current Run Time: 4.5 hrs/day
Max. Current Run Time: 7.1 hrs/day

Avg. Current Daily Flow: (4.5 hrs/day) x (1,005 GPM) x (60 min./hr.) = 271,350 GPD
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (7.1 hrs/day) / (4.5 hrs/day) = 1.58
Current Available Peak Factor: (24 hrs) / (4.5 hrs) = 5.33

Huntfield (303)

The Huntfield Pump Station runs an average of 24.9 hours per day and has a current available peaking factor of 0.96. Analysis indicates that the pump station is operating over capacity. Because the Tuscawilla WWTP is offline, this pump station collects all flow from the Tuscawilla service area. Once the Tuscawilla WWTP is online, the pump station will be relieved from the high amount of flow. Continued monitoring of this pump station is recommended. See **Appendix S** for more information.

Pump Model	Flygt 3152.181
No. of Pumps	2
Duty Point	113.17 GPM @ 162.29 TDH
2020 Avg. Hours/Day	24.9
2020 Max. Hours/Day	49.2
Wet Well Dim.	Unknown Diam. X 27.33’
Monitoring System	Omni
Force Main Size	unknown

Pump Flow Rate: unknown
Avg. Current Run Time: 24.9 hrs/day
Max. Current Run Time: 49.2 hrs/day

Avg. Current Daily Flow: unknown
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (49.2 hrs/day) / (24.9 hrs/day) = 1.98
Current Available Peak Factor: (24 hrs) / (24.9 hrs) = 0.96

Demory (307)

The Demory Pump Station currently runs an average of 1.8 hours per day and has a current available peak factor of 13.33 hours. Analysis indicates the Pump Station is operating below capacity; however, results of the hydraulic model indicate calculated flows based on pump run time may not be accurate and that flow monitoring should be conducted. See **Appendix T** for more information.

Pump Model	Yeomans 9100-412.3SV
No. of Pumps	2
Duty Point	335 GPM @ 118' TDH
2020 Avg. Hours/Day	1.8
2020 Max. Hours/Day	3.4
Wet Well Dim.	8' Diam. X 26'
Monitoring System	Flow Meter
Force Main Size	6"

Pump Flow Rate: 335 GPM
Avg. Current Run Time: 1.8 hrs/day
Max. Current Run Time: 3.4 hrs/day

Avg. Current Daily Flow: (1.8 hrs/day) x (335 GPM) x (60 min./hr.) = 36,180 GPD
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (3.4 hrs/day) / (1.8 hrs/day) = 1.89
Current Available Peak Factor: (24 hrs) / (1.8 hrs) = 13.33

Willow Spring (309)

The Willow Spring Pump Station currently runs an average of 3.6 hours per day and has a current available peak factor of 6.67. Analysis indicates that the pump station is operating below capacity, however results of the hydraulic model indicate calculated flows based on pump run time may not be accurate and that flow monitoring should be conducted. See **Appendix U** for more information.

Pump Model	Yeomans 9100-4153
No. of Pumps	2
Duty Point	370 GPM @ 157' TDH
2020 Avg. Hours/Day	3.6
2020 Max. Hours/Day	6.7
Wet Well Dim.	8' Diam. X 28'4"
Monitoring System	Flow Meter
Force Main Size	6"

Pump Flow Rate: 370 GPM
Avg. Current Run Time: 3.6 hrs/day
Max. Current Run Time: 6.7 hrs/day

Avg. Current Daily Flow: (3.6 hrs/day) x (370 GPM) x (60 min./hr.) = 79,920 GPD
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (6.7 hrs/day) / (3.6 hrs/day) = 1.86
Current Available Peak Factor: (24 hrs) / (3.6 hrs) = 6.67

Clarence Drive (310)

The Clarence Drive Pump Station currently runs an average of 5.3 hours per day and has a current available peak factor of 4.53. Analysis indicates that the Pump Station is operating below capacity, however the capacity should be reevaluated if any future development is proposed. In addition, results of the hydraulic model indicate calculated flows based on pump run time may not be accurate and that flow monitoring should be conducted. See **Appendix V** for more information.

Pump Model	Yeomans 9100-412.3SV
No. of Pumps	2
Duty Point	425 GPM @ 79' TDH
2020 Avg. Hours/Day	5.3
2020 Max. Hours/Day	8.8
Wet Well Dim.	8' Diam. X 21'10"
Monitoring System	Flow Meter
Force Main Size	6"

Pump Flow Rate: 425 GPM
Avg. Current Run Time: 5.3 hrs/day
Max. Current Run Time: 8.8 hrs/day

Avg. Current Daily Flow: (5.3 hrs/day) x (425 GPM) x (60 min./hr.) = 135,150 GPD
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (8.8 hrs/day) / (5.3 hrs/day) = 1.66
Current Available Peak Factor: (24 hrs) / (5.3 hrs) = 4.53

Marlowe Road / Tractor Supply (313)

The Marlowe Road/Tractor Supply Pump Station is currently running an average of 5.3 hours per day and has a current available peak factor of 4.5. Analysis indicates that the Pump Station is currently operating below capacity. If future development is proposed, the capacity of the pump station should be reevaluated. See **Appendix W** for more information.

Pump Model	Ebara 80DVCFU6152
No. of Pumps	2
Duty Point	unknown
2020 Avg. Hours/Day	5.3
2020 Max. Hours/Day	7.2
Wet Well Dim.	unknown
Monitoring System	Omni
Force Main Size	unknown

Pump Flow Rate: unknown
Avg. Current Run Time: 5.3 hrs/day
Max. Current Run Time: 7.2 hrs/day

Avg. Current Daily Flow: unknown
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (7.2 hrs/day) / (5.3 hrs/day) = 1.36
Current Available Peak Factor: (24 hrs) / (5.3 hrs) = 4.5

Flowing Spring (R-1)

The Flowing Spring Pump Station is currently running an average of 4.5 hours per day and has a current available peak factor of 5.33. Analysis indicates that the Pump Station is currently operating below capacity. If future development is proposed in the service area, the impact on the pump station's capacity should be evaluated. See **Appendix X** for more information.

Pump Model	unknown
No. of Pumps	3
Duty Point	900 GPM
2020 Avg. Hours/Day	4.5
2020 Max. Hours/Day	6.8
Wet Well Dim.	10' Diam. X 27'
Monitoring System	Omni
Force Main Size	12"

Pump Flow Rate: 900 GPM
Avg. Current Run Time: 4.5 hrs/day
Max. Current Run Time: 6.8 hrs/day

Avg. Current Daily Flow: (4.5 hrs/day) x (900 GPM) x (60 min./hr.) = 243,000 GPD
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (6.8 hrs/day) / (4.5 hrs/day) = 1.51
Current Available Peak Factor: (24 hrs) / (4.5 hrs) = 5.33

4th Avenue (R-2)

The 4th Avenue Pump Station is currently running an average of 2.2 hours per day and has a current available peak factor of 10.9. Analysis indicates that the Pump Station is currently operating below capacity. See **Appendix Y** for more information.

Pump Model	unknown
No. of Pumps	2
Duty Point	unknown
2020 Avg. Hours/Day	2.2
2020 Max. Hours/Day	4.5
Wet Well Dim.	6' Diam. X 20'
Monitoring System	Mission
Force Main Size	unknown

Pump Flow Rate: unknown
Avg. Current Run Time: 2.2 hrs/day
Max. Current Run Time: 4.5 hrs/day

Avg. Current Daily Flow: unknown
Industry Standard Peaking Factor: 3.5 to 4.0
Current Actual Operating Peak Factor: (Max. Current Run Time) / (Avg. Current Run Time) = (4.5 hrs/day) / (2.2 hrs/day) = 2.05
Current Available Peak Factor: (24 hrs) / (2.2 hrs) = 10.9

Forrest Street (R-4)

The Forrest Street Pump Station pump hours are not recorded by operators. The Mission System does record the number of gallons per day. Based on the Mission System and O&M Manuals, the Pump Station is running an average of 2.2 hours per day and has a current available peak factor of 10.9. Analysis indicates that the pump station is currently operating below capacity. See **Appendix Z** for more information.

Pump Model	Hydromatic HPG200M2-2
No. of Pumps	2
Duty Point	45 GPM
Wet Well Dim.	4' Diam X 10'
Monitoring System	Mission
Force Main Size	2"

Pump Flow Rate: 45 GPM

Avg. Current Daily Flow: 5,750 GPD
Industry Standard Peaking Factor: 3.5 to 4.0
Avg. Current Run Time: (Gallons Per Day) / (Duty Point) = (5,750 GPD) / (45 GPM x 60 min/hr) = 2.2 hrs/day
Current Available Peak Factor: (24 hrs) / (2.2 hrs/day) = 10.9

VI. SUGGESTED FUTURE MODELING EFFORTS

a. GIS Data

1. Sewer segments of conveyance sewers south of the Park, from MH CT-243 to MH CT-314 should be surveyed. Current GIS data in this area is questionable, resulting in inaccurate model predictions. **Exhibit 4** shows the area to be surveyed. Upon review of the model results it appears that existing Manhole and Sewer GIS data may be in an alternate datum.

b. Flow Allocation/EDU Distribution

1. EDU allocations based on flow meter results should be adjusted. Although these areas will no longer be customer based, the model will be more representative of observed flows.

2. The skeletonized nature of the current model leads to multiple basins being associated with each load node. The model was developed to be easily updated as new basins are added and EDUs are reallocated.

3. The minor basin delineation should be updated as the model is refined. It is recommended that the delineation be parcel-based as it helps maintain more accurate EDU counts for each basin. Maintaining accurate EDU counts is needed to improve the accuracy of the model.

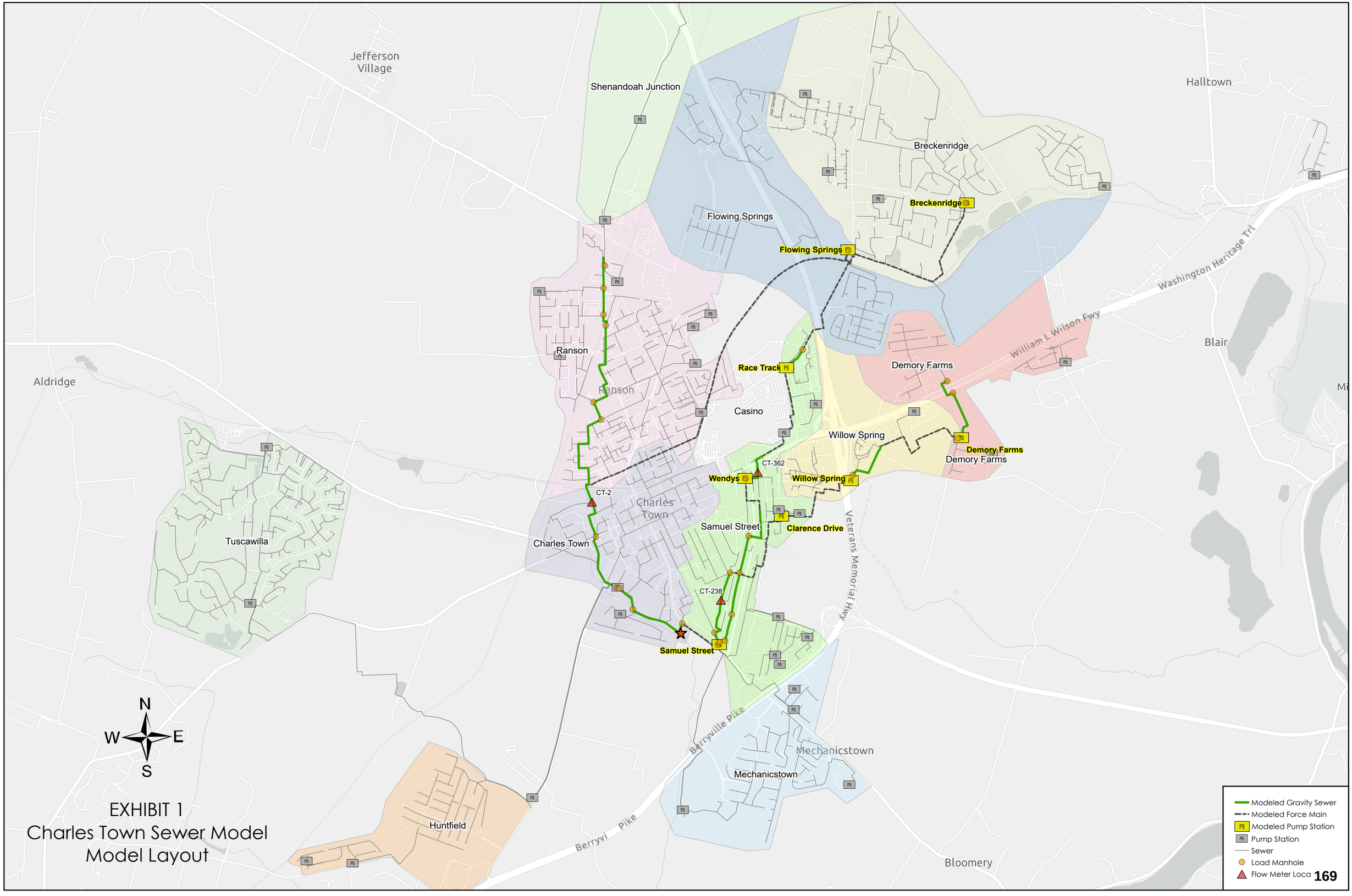
c. Flow Monitoring/Wet Weather Analysis

1. It is recommended that the next round of flow metering studies be conducted within the Ranson service area. The flow meters will help to verify contributions from the northern drainage basins and verify any variation in diurnal patterns.

2. A flowmeter/rain gauge monitoring program for maintaining model ready data should be developed. The regular review of data will provide improved tools for managing system wide I/I as well as a means for updating and further calibrating the conveyance system model. Thereby, developing a model that improves system evaluation during system growth and troubleshooting problems as they arise.

APPENDIX A

EXHIBITS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Halltown
Breckenridge
Breckenridge
Flowing Springs
Flowing Springs
Washington Heritage Trl
William L Wilson Fwy
Blair
Ranson
Ranson
Aldridge
Race Track
Casino
Demory Farms
Demory Farms
Demory Farms
Willow Spring
Willow Spring
CT-362
Wendys
CT-2
Charles Town
Charles Town
Samuel Street
Clarence Drive
Veterans Memorial Hwy
CT-238
Samuel Street
Tuscawilla
Berryville Pike
Mechanicstown
Mechanicstown
Huntfield
Berryvi Pike
Bloomery
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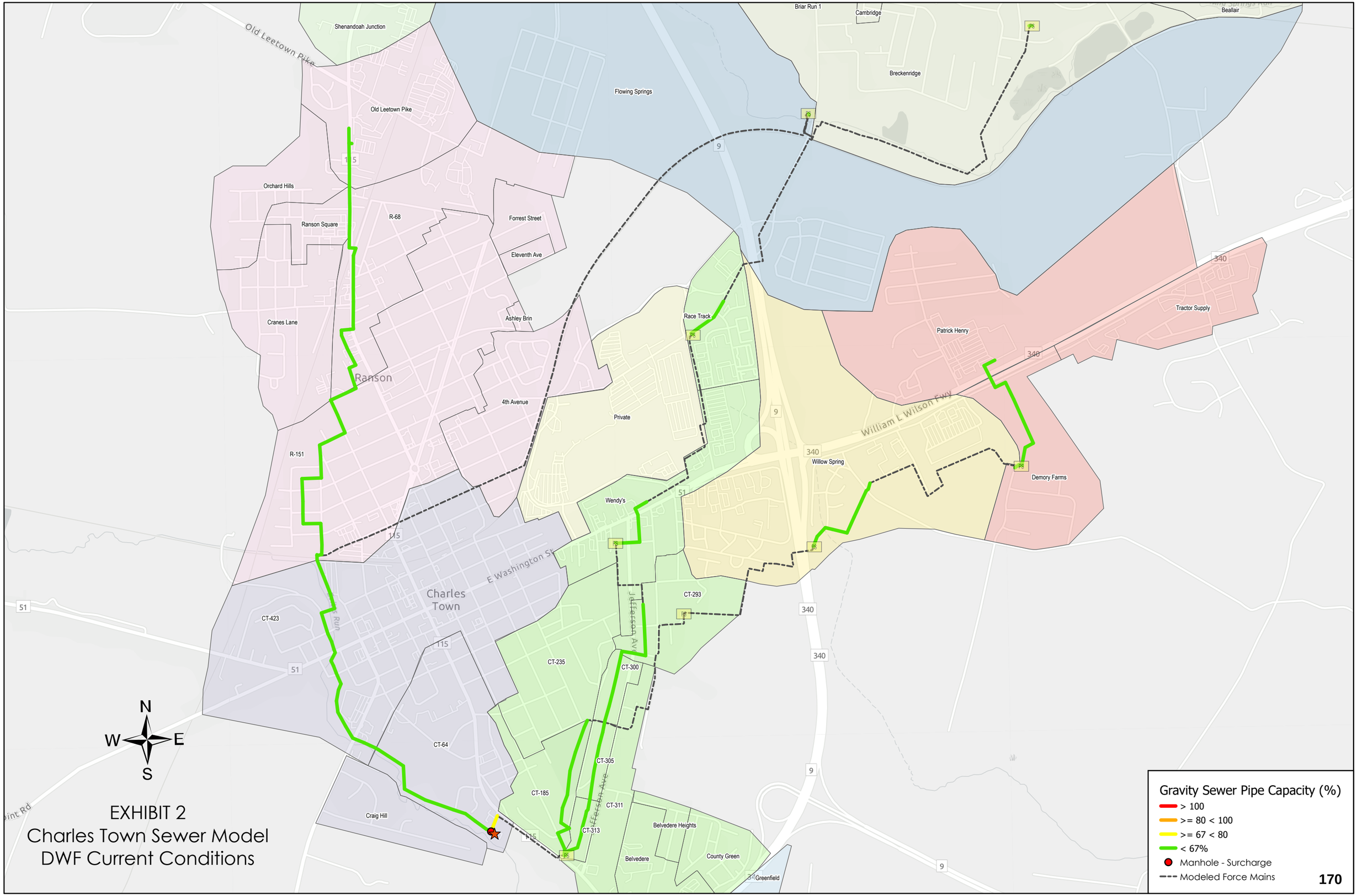
EXHIBIT 1
Charles Town Sewer Model
Model Layout
Modeled Gravity Sewer
Modeled Force Main
Modeled Pump Station
Pump Station
Sewer
Load Manhole
Flow Meter Loca
169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Shenandoah Junction
Old Leetown Pike
Orchard Hills
Ranson Square
R-68
Forrest Street
Eleventh Ave
Cranes Lane
Ashley Brin
Ranson
4th Avenue
R-151
Private
Flowing Springs
Briar Run 1
Cambridge
Breckenridge
Beallair
Race Track
Patrick Henry
Tractor Supply
William L Wilson Fwy
Willow Spring
Demory Farms
Wendy's
CT-293
CT-235
CT-300
CT-305
CT-185
CT-311
CT-313
Belvedere Heights
Belvedere
County Green
Greenfield
CT-423
CT-64
Craig Hill
Charles Town
E Washington St
Jefferson Ave
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51
9
340
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W
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S
EXHIBIT 2
Charles Town Sewer Model
DWF Current Conditions
Gravity Sewer Pipe Capacity (%)
> 100
>= 80 < 100
>= 67 < 80
< 67%
Manhole - Surcharge
Modeled Force Mains
170

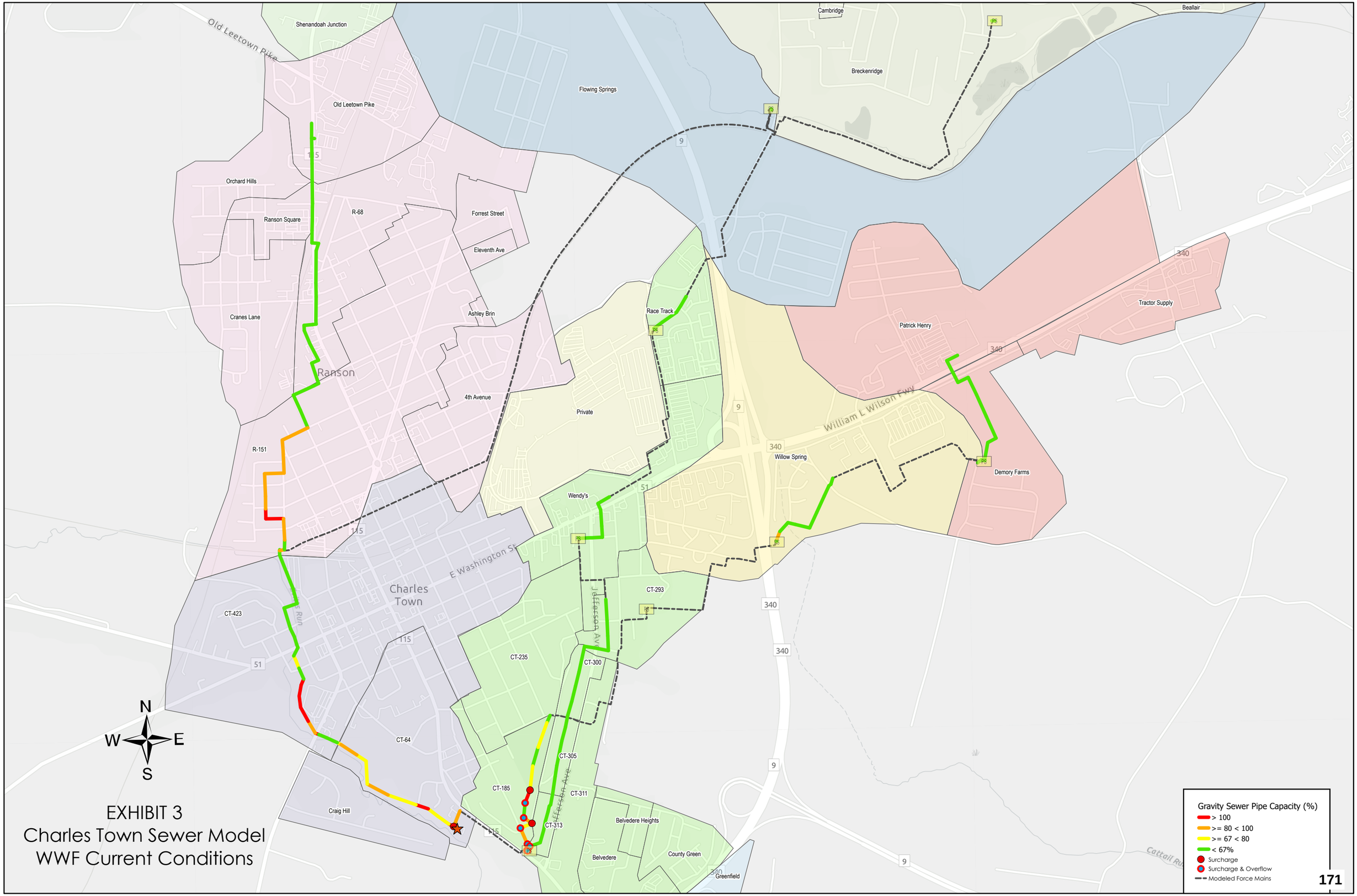
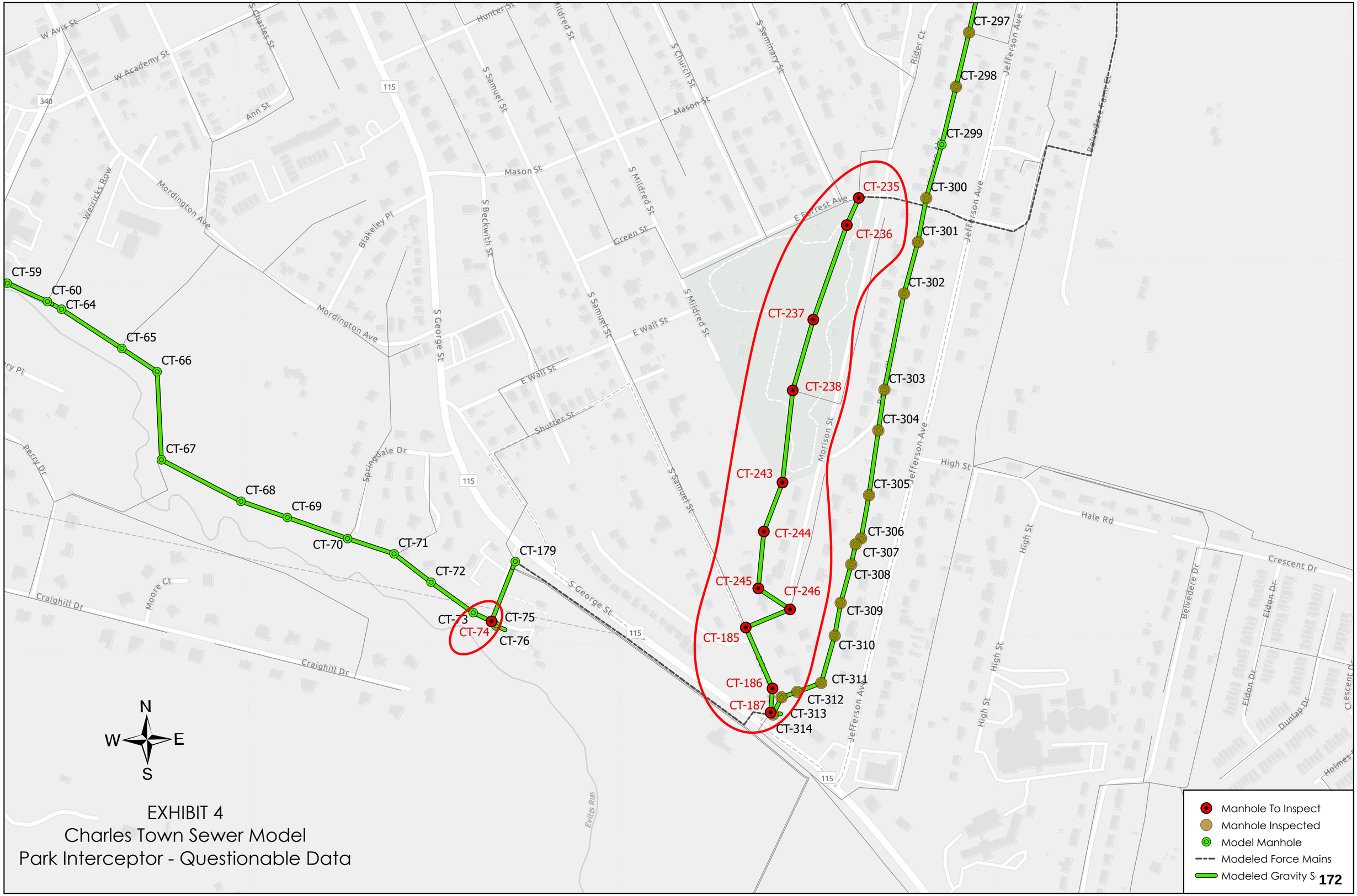


EXHIBIT 3
Charles Town Sewer Model
WWF Current Conditions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CT-314
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W Academy St
S Charles St
Ann St
Hunter St
S Samuel St
S Mildred St
S Church St
S Seminary St
Rider Ct
Jefferson Ave
Belvedere Farm Ct
Mason St
Weirticks Row
Mordington Ave
Blakeley Pl
S Beckwith St
Green St
E Forrest Ave
S George St
E Wall St
Shutter St
Springdale Dr
Perry Dr
Moore Ct
Craighill Dr
Evitts Run
Morison St
Jefferson Ave
High St
Hale Rd
Belvedere Dr
Crescent Dr
Eldon Dr
Dunlap Dr
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S
EXHIBIT 4
Charles Town Sewer Model
Park Interceptor - Questionable Data
Manhole To Inspect
Manhole Inspected
Model Manhole
Modeled Force Mains
Modeled Gravity S

APPENDIX B

HYDRAULIC MODEL LOADING TABLE

CTUB Current Flows (2020)								
	Minor Basin	Manhole	Residential EDU Count	Residential Flow* (gpd)	Commercial Flow (gpd)	Equivalent Commercial EDU Count	Total EDU Count	Flow (gpd)
BRECKENRIDGE	Beallair	BK-52	108	16,200	0	0	108.0	16,200
	Breckenridge	BK-52	855	128,250	0	0	855.0	128,250
	Briar Run 1	BK-52	59	8,850	0	0	59.0	8,850
	Briar Run 2	BK-52	151	22,650	0	0	151.0	22,650
	Cambridge	BK-52	12	1,800	0	0	12.0	1,800
CHARLES TOWN	Craig Hill	CT-67	48	7,200	100	0.7	48.7	7,300
	CT-423	CT-423	857	128,550	22,330	148.9	1,005.9	150,880
	CT-64	CT-64	257	38,550	710	4.7	261.7	39,260
DEMORY FARMS	Demory Farms	DM-1	74	11,100	0	0	74.0	11,100
	Patrick Henry	W1	231	34,650	21,510	143.4	374.4	56,160
FLOWING SPRINGS	Flowing Springs	FSPS-2	623	93,450	0	0	623.0	93,450
HUNTFIELD	Huntfield	CT-60	421	63,150	0	0	421.0	63,150
	Spruce Hill 1	CT-60	77	11,550	0	0	77.0	11,550
	Spruce HIll 2	CT-60	42	6,300	0	0	42.0	6,300
MECHANICSTOWN	Greenfield	CT-187	318	47,700	360	2.4	320.4	48,060
	Norborne	CT-179	164	24,600	0	0	164.0	24,600

CTUB Current Flows (2020)								
	Minor Basin	Manhole	Residential EDU Count	Residential Flow* (gpd)	Commercial Flow (gpd)	Equivalent Commercial EDU Count	Total EDU Count	Flow (gpd)
RANSON	4th Avenue	R-151	326	48,900	2,050	13.7	339.7	50,950
	Ashley Brin	R-151	8	1,200	0	0	8.0	1,200
	Cranes Lane	R-149	269	40,350	110	0.7	269.7	40,460
	Eleventh Ave	R-151	15	2,250	0	0	15.0	2,250
	Forrest Street	R-151	36	5,400	0	0	36.0	5,400
	Old Leetown Pike	R-3	64	9,600	1,260	8.4	72.4	10,860
	Orchard Hills	R-7	126	18,900	0	0	126.0	18,900
	R-151	R-151	626	93,900	17,020	113.5	739.5	110,920
	R-68	R-68	168	25,200	5,110	34.1	202.1	30,310
	Ranson Square	R-19	79	11,850	14,860	99.1	178.1	26,710
SAMUEL STREET	Belvedere	CT-187	21	3,150	320	2.1	23.1	3,470
	Belvedere Heights	CT-187	24	3,600	0	0	24.0	3,600
	County Green	CT-187	208	31,200	0	0	208.0	31,200
	CT-185	CT-185	60	9,000	0	0	60.0	9,000
	CT-235	CT-235	159	23,850	10	0.1	159.1	23,860
	CT-293	CT-293	63	9,450	4,940	32.9	95.9	14,390
	CT-300	CT-300	31	4,650	0	0	31.0	4,650
	CT-305	CT-305	28	4,200	0	0	28.0	4,200
	CT-311	CT-311	65	9,750	50	0.3	65.3	9,800
	CT-313	CT-313	13	1,950	0	0	13.0	1,950
	Race Track	JC-14	120	18,000	21,940	146.3	266.3	39,940
	Wendy's	CT-278	102	15,300	21,390	142.6	244.6	36,690

CTUB Current Flows (2020)								
	Minor Basin	Manhole	Residential EDU Count	Residential Flow* (gpd)	Commercial Flow (gpd)	Equivalent Commercial EDU Count	Total EDU Count	Flow (gpd)
SHENANDOAH JUNCTION	Shenandoah Junction	R-3	155	23,250	0	0	155.0	23,250
TUSCAWILLA	Tuscawilla	CT-60	1110	166,500	0	0	1,110.0	166,500
WILLOW SPRING	Tractor Supply	CT-462	134	20,100	1,060	7.1	141.1	21,160
	Willow Spring	CT-462	315	47,250	19,320	128.8	443.8	66,570
		Totals	8,622	1,293,300	154,450	1,029.8	9,651.8	1,447,750

* Residential Flow 150 GPD/EDU

APPENDIX C

MODEL CALIBRATION RESULTS

	Upstream EDU Count [1]	Predicted Flow [1] (gpd)	Avg. Pumping Rate[2] (gpm)	Avg. Run Time [3] (Hrs/Day)	Avg. Flow (gpd)	Max. Run Time (Hrs/Day)	Max. Flow (gpd)	Max. Flow Peaking Factor (PF_{MAX})	Diff. in Model Prediction vs. Observed		Report Period
Modeled MH/PS											
Breckenridge PS	1185	177,750	600.00	4.62	166,234	10.43	375,600	2.26	11,516	6.5%	1/7/20 - 8/25/20
Flowing Springs PS	1808	271,200	900.00	4.53	244,384	6.75	364,500	1.49	26,816	9.9%	1/7/20 - 8/28/20
Race Track PS	266.3	39,940	250.00	1.24	18,569	2.13	32,000	1.72	21,371	53.5%	1/7/20 - 8/28/20
CT-362[4]	338.4	50,755			95,130		220,967	2.32	-44,375	-87.4%	10/1/20 - 10/9/20
Wendy's PS	521.7	78,250	410.00	1.73	42,496	2.37	58,425	1.37	35,754	45.7%	1/2/20 - 8/31/20
Demory Farms PS[4]	448.4	67,260			51,400		69,240	1.35	15,860	23.6%	1/3/20 - 8/28/20
Willow Spring PS[4]	1033.3	154,995			125,000		175,000	1.40	29,995	19.4%	1/2/20 - 8/31/20
Clarence Drive PS[4]	1033.3	154,995			125,000		175,000	1.40	29,995	19.4%	1/2/20 - 8/31/20
CT-238[4]	1192.4	178,860			70,232		375,772	5.35	108,628	60.7%	12/15/19 - 12/27/19
Samuel Street PS[5]	2746.765	412,015	1,005.00	5.00	301,500	7.13	429,638	1.43	110,515	26.8%	
CT-2[4]	2225.1	333,765			345,043		1,143,233	3.31	-11,278	-3.4%	11/3/20 - 12/3/20
CTUB WWTP Flow Data											
2018											
Charles Town WWTP	9651.8	1,447,770			1,340,000				-102,230	-7.1%	
Tuscawilla WWTP					210,000						
2019											
Charles Town WWTP	9651.8	1,447,770			1,260,000				37,770	2.6%	
Tuscawilla WWTP					150,000						

(1) Flow and/or EDU Count based on CTUB supplied Residential and Commercial Customer Data - 150 GPD/EDU
(2) Average Pumping rates based on pump duty points
(3) CTUB Operator's Logs
(4) Average and Maximum Flows based on flow meter data supplied by CTUB
(5) Pump Station data based on data CTUB's Mission SCADA System

APPENDIX D

CURRENT RESULTS FOR DRY WEATHER AND WET WEATHER FLOWS

	Start Node	Stop Node	Upstream Invert Elev.	Downstream Invert Elev.	Diameter (in)	Design Capacity (MGD)	Current (2020) Dry Weather Flows			Current (2020) Wet Weather Flows		
							Max. Flow (MGD)	% of Capacity	Depth/Diameter Ratio	Max. Flow (MGD)	% of Capacity	Depth/Diameter Ratio
BRECKENRIDGE												
Breckenridge Minor Basin												
01	BK-52	BK-WW	426	425	12	3.30	0.31	9.30	24.60	0.62	18.85	35.30
CHARLES TOWN												
CT-423 Minor Basin												
01	R-259	CT-2	485.44	483.99	18	3.83	1.07	27.98	34.40	2.11	55.00	51.00
02	CT-2	CT-3	483.99	483.53	18	4.33	1.00	23.05	31.90	2.10	48.59	47.50
03	CT-3	CT-39	483.53	480.86	18	6.98	0.98	14.10	32.60	2.10	30.10	49.40
04	CT-39	CT-40	480.86	480.16	18	3.82	0.97	25.31	33.60	2.10	55.01	52.00
05	CT-40	CT-41	480.16	478.93	18	4.05	0.95	23.42	33.40	2.10	51.88	52.30
06	CT-41	CT-42	478.93	478.51	18	3.74	0.92	24.64	33.10	2.10	56.07	52.30
07	CT-42	CT-43	478.51	478.06	18	4.03	0.91	22.62	32.80	2.09	51.98	53.10
08	CT-43	CT-423	478.06	477.88	18	3.82	0.91	23.78	34.90	2.09	54.85	57.30
09	CT-423	CT-45	477.88	477.39	18	3.92	1.12	28.49	36.70	2.61	66.44	60.00
10	CT-45	CT-46	477.39	477.11	18	3.83	1.12	29.10	37.00	2.60	**67.93**	60.70
11	CT-46	CT-47	477.11	476.72	18	3.79	1.11	29.40	35.00	2.60	**68.72**	56.10
12	CT-47	CT-48	476.72	475.23	18	6.04	1.11	18.39	40.50	2.60	43.05	**69.80**
13	CT-48	CT-49	475.23	475.11	18	2.29	1.11	48.45	47.60	2.60	**113.70**	**87.60**
14	CT-49	CT-50	475.11	474.87	18	2.50	1.11	44.26	47.80	2.60	**104.18**	**87.00**
15	CT-50	CT-55	474.87	474.66	18	2.31	1.10	47.55	48.50	2.60	**112.53**	**85.60**
16	CT-55	CT-56	474.66	474.38	18	2.25	1.09	48.55	46.10	2.60	**115.48**	**79.40**
17	CT-56	CT-57	474.38	474.02	18	2.74	1.09	39.65	43.40	2.60	**94.88**	**71.50**
18	CT-57	CT-58	474.02	473.95	18	2.35	1.08	45.98	37.70	2.60	**110.54**	59.80
19	CT-58	CT-59	473.45	473.31	24	4.65	1.08	23.20	33.60	2.60	55.77	59.50
20	CT-59	CT-60	473.31	473.09	24	5.05	1.08	21.37	36.60	2.59	51.39	63.80
CT-64 Minor Basin												
21	CT-60	CT-64	473.09	473.03	24	4.38	1.42	32.43	39.40	3.45	**78.87**	66.90
22	CT-64	CT-65	473.03	472.75	24	4.46	1.47	33.07	38.90	3.59	**80.57**	66.30
23	CT-65	CT-66	472.75	472.57	24	4.67	1.47	31.45	38.30	3.59	**76.83**	65.70
24	CT-66	CT-67	472.57	472.18	24	4.76	1.47	30.83	38.80	3.59	**75.42**	66.40
25	CT-67	CT-68	472.18	471.83	24	4.47	1.47	32.92	38.60	3.61	**80.75**	66.40
26	CT-68	CT-69	471.83	471.6	24	4.90	1.47	30.00	38.40	3.60	**73.53**	66.50
27	CT-69	CT-70	471.6	471.31	24	4.82	1.47	30.47	40.80	3.60	**74.75**	**68.70**
28	CT-70	CT-71	471.31	471.22	24	3.07	1.46	47.75	39.90	3.60	**117.36**	66.50
29	CT-71	CT-72	471.22	470.97	24	5.24	1.46	27.91	39.40	3.60	**68.71**	64.00
30	CT-72	CT-73	470.97	470.7	24	5.15	1.46	28.33	45.80	3.60	**69.80**	66.60
31	CT-73	CT-74	470.7	470.65	24	3.55	1.46	41.12	50.50	3.59	**101.34**	**67.30**
32	CT-74	CT-75	470.65	470.63	24	5.15	3.89	**75.54**	49.10	6.39	**124.11**	64.00
33	CT-75	CT-76	470.63	470.6	24	7.66	3.88	50.74	45.30	6.39	**83.48**	59.00
34	CT-76	WWTP	470.6	470	24	0.00	3.88	0.00	37.90	6.39	0.00	49.60
35	CT-179	CT-74	475.9	470.65	12	3.22	2.50	**77.69**	**92.80**	2.81	**87.25**	**100.00**

	Start Node	Stop Node	Upstream Invert Elev.	Downstream Invert Elev.	Diameter (in)	Design Capacity (MGD)	Current (2020) Dry Weather Flows			Current (2020) Wet Weather Flows		
							Max. Flow (MGD)	% of Capacity	Depth/Diameter Ratio	Max. Flow (MGD)	% of Capacity	Depth/Diameter Ratio
DEMORY FARMS												
Demory Farms Minor Basin												
03	W3	W4	432.58	431.49	12	1.78	0.08	4.40	14.30	0.20	11.03	22.60
04	W4	W5	431.36	428.36	12	2.28	0.11	4.74	15.80	0.27	11.86	25.00
05	W5	W6	428.22	427.18	12	1.20	0.11	8.98	18.50	0.27	22.48	29.50
06	W6	W7	427.03	425.91	12	1.25	0.11	8.64	18.30	0.27	21.61	29.20
07	W7	W8	425.76	425.21	12	1.40	0.11	7.72	17.80	0.27	19.29	28.30
08	W8	W9	425.05	423.92	12	1.43	0.11	7.54	17.70	0.27	18.86	28.10
09	W9	DF-WW	423.8	423.55	12	3.95	0.12	3.12	15.10	0.31	7.81	24.20
10	DM-1	W10	431.16	430.8	12	1.59	0.02	0.98	6.60	0.04	2.45	10.40
11	W10	W9	430.17	429.65	12	2.35	0.02	0.66	6.10	0.04	1.66	9.50
Patrick Henry Minor Basin												
01	W1	W2	438.83	435.8	12	2.91	0.08	2.70	12.80	0.20	6.77	20.20
02	W2	W3	435.67	432.69	12	2.02	0.08	3.90	13.90	0.20	9.76	21.90
FLOWING SPRINGS												
Flowing Springs Minor Basin												
01	FSPS-2	FSPS-3	438.08	438.02	15	3.01	0.43	14.44	27.90	0.99	32.86	43.50
02	FSPS-3	FS-WW	438.01	437.99	15	1.67	0.43	26.02	28.30	0.99	59.22	42.80
RANSON												
Old Leetown Pike Minor Basin												
01	R-1	R-2	551	550.22	8	0.45	0.00	0.00	1.80	0.00	0.00	7.30
02	R-3	R-2	551.38	550.37	8	1.16	0.05	4.11	16.20	0.12	10.30	25.60
03	R-2	R-4	550.12	542.4	8	1.26	0.05	3.78	15.90	0.12	9.46	25.20
04	R-4	R-6	542.15	540.83	8	0.85	0.05	5.60	17.30	0.12	14.02	27.50
05	R-6	R-7	540.58	535.39	8	1.07	0.05	4.44	16.40	0.12	11.12	26.10
R-68 Minor Basin												
06	R-7	R-24	535.14	530.5	8	1.01	0.07	7.33	23.20	0.19	18.36	37.10
07	R-24	R-23	530.5	529.43	8	0.88	0.07	8.45	23.20	0.19	21.15	37.10
08	R-23	R-22	529.43	528.68	8	0.89	0.07	8.32	23.20	0.19	20.83	37.10
09	R-22	R-21	528.68	525.88	8	0.88	0.07	8.42	23.20	0.19	21.08	37.10
10	R-21	R-19	525.88	523.1	8	1.06	0.07	7.02	20.60	0.19	17.58	32.80
11	R-19	R-25	523	520	8	0.96	0.11	11.57	25.80	0.28	28.99	41.40
12	R-25	R-67	517	516.2	8	0.68	0.11	16.44	28.00	0.28	41.16	45.30
13	R-67	R-68	516.1	515.68	8	0.46	0.11	24.39	31.10	0.28	61.06	51.20
14	R-68	R-128	515.58	507.98	10	1.72	0.15	8.93	22.70	0.39	22.35	36.40
15	R-128	R-129	506.07	505.52	10	0.70	0.15	21.90	32.10	0.38	54.83	53.40
16	R-129	R-130	505.52	504.66	10	0.68	0.15	22.70	29.70	0.38	56.82	49.00
17	R-130	R-131	504.66	504.4	10	0.96	0.15	16.07	30.70	0.38	40.18	50.20
18	R-131	R-132	504.4	504.3	10	0.59	0.15	25.96	32.70	0.38	64.92	53.80
19	R-132	R-137	504.3	503.93	10	0.74	0.15	20.81	33.00	0.38	52.02	53.50
20	R-137	R-138	503.93	503.83	12	0.79	0.15	19.34	26.50	0.38	48.36	42.30
21	R-138	R-139	503.83	503.16	12	1.24	0.15	12.41	24.30	0.38	31.03	39.10
22	R-139	R-141	503.16	502.44	12	1.14	0.15	13.43	24.80	0.38	33.60	40.10
23	R-141	R-142	502.44	502.16	12	1.13	0.15	13.59	22.50	0.38	33.99	36.10
24	R-142	R-143	502.16	499.92	12	2.02	0.15	7.59	21.00	0.38	18.99	33.50
25	R-143	R-144	499.92	499.71	12	1.46	0.15	10.54	21.00	0.38	26.35	33.50
26	R-144	R-148	499.71	498.52	12	2.70	0.15	5.70	19.90	0.38	14.24	32.00
27	R-148	R-149	498.52	495.09	12	2.26	0.15	6.81	24.40	0.38	17.02	39.60

	Start Node	Stop Node	Upstream Invert Elev.	Downstream Invert Elev.	Diameter (in)	Design Capacity (MGD)	Current (2020) Dry Weather Flows			Current (2020) Wet Weather Flows		
							Max. Flow (MGD)	% of Capacity	Depth/Diameter Ratio	Max. Flow (MGD)	% of Capacity	Depth/Diameter Ratio
R-151 Minor Basin												
28	R-149	R-150	495.09	494.43	12	1.16	0.21	18.09	29.00	0.52	45.22	47.50
29	R-150	R-151	494.43	493.69	12	1.13	0.21	18.62	36.10	0.52	46.55	63.40
30	R-151	R-232	493.69	492.88	12	1.16	0.45	38.46	43.10	1.12	**96.36**	**79.20**
31	R-232	R-233	492.88	492.54	12	1.16	0.45	38.76	43.20	1.12	**97.03**	**79.50**
32	R-233	R-234	492.54	492.1	12	1.15	0.45	38.87	43.20	1.12	**97.29**	**79.50**
33	R-234	R-235	492.1	491.22	12	1.16	0.45	38.76	43.40	1.12	**96.95**	**79.90**
34	R-235	R-236	491.22	490.46	12	1.14	0.45	39.30	43.40	1.12	**98.25**	**80.10**
35	R-236	R-241	490.46	489.56	12	1.15	0.45	38.94	43.30	1.12	**97.35**	**80.90**
36	R-241	R-242	489.56	489.06	12	1.15	0.45	38.82	43.90	1.12	**97.03**	**85.40**
37	R-242	R-246	489.06	488.7	12	1.10	0.45	40.88	46.00	1.12	**102.17**	**90.50**
38	R-246	R-247	488.7	488.19	12	0.98	0.45	45.73	45.30	1.12	**114.27**	**85.70**
39	R-247	R-249	488.19	487.33	12	1.15	0.45	38.76	38.90	1.12	**96.80**	**67.60**
40	R-249	R-250	487.33	486.03	12	2.12	0.45	21.11	32.90	1.12	52.71	60.40
41	R-250	R-251	485.93	485.71	12	1.21	0.45	36.86	47.50	1.12	**92.05**	**75.10**
42	R-252	R-251	485.9	485.71	18	7.76	0.67	8.61	30.00	1.01	13.03	41.10
43	R-251	R-259	485.71	485.44	18	4.18	1.08	25.94	35.50	2.11	50.45	51.60
SAMUEL STREET												
CT-185 Minor Basin												
01	CT-235	CT-236	484.56	475.9	10	3.74	0.36	9.56	30.00	0.78	20.94	45.00
02	CT-236	CT-237	475.8	473	10	1.16	0.36	30.82	38.60	0.78	**67.04**	59.30
03	CT-237	CT-238	472.9	469.8	10	1.42	0.35	24.51	36.20	0.73	51.09	**73.60**
04	CT-238	CT-243	469.7	468.2	10	0.88	0.34	38.04	49.30	0.70	**79.87**	**100.00**
05	CT-243	CT-244	468.2	467.9	10	0.52	0.32	60.20	46.30	0.67	**128.58**	**100.00**
06	CT-244	CT-245	467.8	466.2	10	1.16	0.30	25.74	35.10	0.66	56.63	**100.00**
07	CT-245	CT-246	466.1	465.7	10	0.71	0.29	41.19	40.00	0.65	**91.41**	**100.00**
08	CT-246	CT-185	465.6	464.8	10	0.90	0.29	32.20	37.00	0.64	**71.86**	**100.00**
09	CT-185	CT-186	464.7	463.9	10	0.76	0.30	39.01	42.50	0.67	**88.12**	**100.00**
10	CT-186	CT-187	463.9	463.58	10	0.80	0.29	36.37	42.00	0.66	**82.97**	**MHMH**
11	CT-187	CT-314	463.58	463.5	10	1.10	0.41	37.22	44.60	0.96	**87.32**	**100.00**
Race Track Minor Basin												
01	JC-14	JC-13	519	514.9	8	1.23	0.06	4.54	17.30	0.14	11.37	27.40
02	JC-13	JC-12	514.8	512.76	8	0.98	0.06	5.70	18.10	0.14	14.28	28.80
03	JC-12	JC-11	511	500.25	8	1.53	0.06	3.65	16.60	0.14	9.14	26.30
04	JC-11	JC-9	500	498	8	0.86	0.06	6.51	18.70	0.14	16.30	29.70
05	JC-9	JC-10	493	492.79	8	0.86	0.06	6.47	18.70	0.14	16.21	29.70
06	JC-10	RT-WW	492.79	492.69	12	1.53	0.06	3.66	12.50	0.14	9.16	19.70
Wendy's Minor Basin												
07	CT-365	CT-364	501.5	500.9	8	0.41	0.08	20.30	27.60	0.20	48.88	44.10
08	CT-364	CT-363	500.9	500	8	0.70	0.08	12.00	24.10	0.19	26.37	36.10
09	CT-363	CT-362	499.75	498.9	8	0.45	0.08	18.43	26.80	0.18	40.13	40.30
10	CT-362	CT-359	498.8	498	8	0.52	0.08	14.75	24.80	0.17	31.54	36.80
11	CT-359	CT-282	497.75	497.1	10	0.89	0.07	8.22	18.40	0.16	17.84	27.20
12	CT-282	CT-281	497.1	497	10	1.61	0.07	4.31	15.50	0.15	9.54	24.20
13	CT-281	CT-279	497	496.75	10	1.26	0.07	5.53	16.40	0.15	12.24	24.50
14	CT-279	CT-278	496.5	495.85	10	0.88	0.07	7.85	26.10	0.15	17.46	31.30
15	CT-278	Wendy's WW	495.85	495.75	10	1.11	0.12	10.56	54.00	0.28	25.11	54.00

	Start Node	Stop Node	Upstream Invert Elev.	Downstream Invert Elev.	Diameter (in)	Design Capacity (MGD)	Current (2020) Dry Weather Flows			Current (2020) Wet Weather Flows		
							Max. Flow (MGD)	% of Capacity	Depth/Diameter Ratio	Max. Flow (MGD)	% of Capacity	Depth/Diameter Ratio
CT-293 Minor Basin												
16	CT-339	CT-338	533	528.5	10	1.63	0.17	10.67	24.50	0.37	22.84	36.20
17	CT-338	CT-337	528.25	527.3	10	0.89	0.17	19.47	28.40	0.35	39.92	42.00
18	CT-337	CT-336	527.28	526.35	10	0.89	0.17	18.80	27.90	0.34	37.73	40.20
19	CT-336	CT-294	526.05	525.21	10	0.86	0.16	18.39	27.40	0.32	37.09	39.50
20	CT-294	CT-293	525.11	524.5	10	0.88	0.15	17.09	26.40	0.31	35.62	38.80
CT-300 Minor Basin												
21	CT-293	CT-297	524.4	522.05	10	1.06	0.16	15.44	26.30	0.36	33.65	39.50
22	CT-297	CT-298	521.8	520.87	10	0.89	0.15	16.86	26.40	0.35	39.09	41.00
23	CT-298	CT-299	520.62	519.62	10	0.90	0.15	16.19	25.90	0.35	38.48	40.70
24	CT-299	CT-300	519.37	518.45	10	0.89	0.14	15.83	25.50	0.34	38.28	40.50
CT-305 Minor Basin												
25	CT-300	CT-301	518.2	517.45	10	0.90	0.14	16.10	25.80	0.35	39.26	41.20
26	CT-301	CT-302	517.2	515.6	10	1.20	0.14	12.02	23.90	0.35	29.03	37.70
27	CT-302	CT-303	515.35	509.8	10	1.65	0.14	8.75	22.20	0.35	21.09	34.90
28	CT-303	CT-304	507.85	506.32	10	1.33	0.14	10.76	23.30	0.35	26.00	36.70
29	CT-304	CT-305	506.07	505.67	10	0.54	0.14	26.45	29.80	0.35	64.00	48.30
CT-313 Minor Basin												
30	CT-305	CT-307	505.42	504.72	10	0.87	0.15	16.94	26.30	0.36	41.12	41.90
31	CT-307	CT-306	504.47	502.5	10	3.43	0.15	4.31	19.50	0.36	10.46	30.50
32	CT-306	CT-308	502.25	498.1	10	3.10	0.15	4.76	19.80	0.36	11.54	31.10
33	CT-308	CT-309	498	496.77	10	1.22	0.15	12.13	24.10	0.36	29.41	38.10
34	CT-309	CT-310	496.52	491.49	10	2.69	0.15	5.47	20.30	0.36	13.27	31.80
35	CT-310	CT-311	491.19	481.73	10	3.04	0.15	4.84	19.90	0.36	11.74	31.10
36	CT-311	CT-312	474	468	10	3.36	0.16	4.78	20.40	0.39	11.62	61.30
37	CT-312	CT-313	467	464.25	10	2.81	0.16	5.70	21.00	0.39	13.86	**100.00**
38	CT-313	CT-314	464	463.8	10	0.71	0.16	23.07	29.40	0.40	56.10	**100.00**
39	CT-314	SS-WW	463.5	461	12	9.05	0.57	6.26	28.20	1.35	14.92	**100.00**
WILLOW SPRING												
Willow Spring Minor Basin												
01	DF1	DF2	450.38	447.13	12	4.16	0.43	10.44	28.00	0.56	13.51	31.90
02	DF2	DF3	446.95	445.78	12	3.80	0.42	11.08	28.00	0.55	14.40	32.10
03	DF3	DF4	445.62	444.92	12	1.43	0.42	29.04	35.10	0.54	37.87	40.50
04	DF4	CT-473	444.77	442.17	12	2.20	0.37	16.77	29.60	0.52	23.46	35.20
05	CT-473	CT-474	442.01	440.67	12	1.62	0.32	19.84	29.70	0.49	30.62	37.20
06	CT-474	DF7	440.57	440.03	12	1.10	0.27	24.35	30.10	0.47	42.26	40.40
07	DF7	CT-463	439.87	432.2	12	5.82	0.22	3.74	18.60	0.43	7.36	26.10
08	CT-463	CT-462	432.13	431.2	12	1.61	0.21	13.13	24.00	0.42	26.26	34.30
09	CT-462	WS2	430.34	430.22	12	0.62	0.28	45.51	36.00	0.60	**96.62**	53.60
10	WS2	WS-WW	430.06	429.91	12	2.81	0.27	9.54	23.90	0.57	20.43	35.70

APPENDIX E

CURRENT
MANHOLE RESULTS DRY WEATHER AND
WET WEATHER FLOWS

	Manhole ID	Coordinates Easting (X)	Coordinates Northing (Y)	Ground Elev.	Manhole Invert Elev.	Current (2020) Dry Weather Flows Maximum HGL Elev.	Current (2020) Dry Weather Flows Freeboard (Ft)	Current (2020) Wet Weather Flows Maximum HGL Elev.	Current (2020) Wet Weather Flows Freeboard (Ft)
BRECKENRIDGE									
Breckenridge Minor Basin									
01	BK-52	2,442,288.70	300,949.73	442.00	426.00	426.29	15.71	426.41	15.59
CHARLES TOWN									
CT-423 Minor Basin									
01	CT-2	2,431,102.29	292,005.76	494.69	483.99	484.48	10.21	484.73	9.96
02	CT-3	2,431,143.19	291,900.28	495.54	483.53	483.99	11.55	484.22	11.32
03	CT-39	2,431,211.32	291,657.43	492.30	480.86	481.37	10.93	481.65	10.65
04	CT-40	2,431,002.57	291,584.56	493.41	480.16	480.65	12.76	480.93	12.48
05	CT-41	2,431,106.01	291,254.21	491.57	478.93	479.44	12.13	479.73	11.84
06	CT-42	2,431,165.79	291,129.28	488.22	478.51	479.00	9.22	479.28	8.94
07	CT-43	2,431,202.43	291,006.94	487.28	478.06	478.56	8.72	478.89	8.39
08	CT-423	2,431,222.99	290,953.83	489.40	477.88	478.43	10.97	478.77	10.63
09	CT-45	2,431,157.10	290,822.54	484.77	477.39	477.94	6.83	478.30	6.47
10	CT-46	2,431,194.46	290,743.05	483.91	477.11	477.67	6.24	478.02	5.89
11	CT-47	2,431,239.93	290,626.34	484.72	476.72	477.21	7.51	477.49	7.23
12	CT-48	2,431,316.20	290,454.58	482.06	475.23	475.95	6.11	476.56	5.50
13	CT-49	2,431,275.88	290,356.96	484.47	475.11	475.82	8.65	476.41	8.06
14	CT-50	2,431,244.31	290,182.42	484.90	474.87	475.60	9.30	476.18	8.72
15	CT-55	2,431,266.08	290,002.56	484.45	474.66	475.39	9.06	475.92	8.53
16	CT-56	2,431,389.20	289,779.73	480.20	474.38	475.04	5.16	475.50	4.70
17	CT-57	2,431,502.03	289,589.37	481.88	474.02	474.66	7.22	475.05	6.83
18	CT-58	2,431,556.77	289,568.78	484.43	473.45	474.11	10.32	474.62	9.81
19	CT-59	2,431,684.23	289,515.54	479.56	473.31	473.99	5.57	474.52	5.04
20	CT-60	2,431,851.98	289,438.59	478.25	473.09	473.88	4.37	474.43	3.82
CT-64 Minor Basin									
21	CT-64	2,431,910.84	289,406.85	479.87	473.03	473.82	6.05	474.37	5.50
22	CT-65	2,432,163.45	289,242.64	475.73	472.75	473.52	2.21	474.06	1.67
23	CT-66	2,432,310.48	289,145.31	476.85	472.57	473.33	3.52	473.88	2.97
24	CT-67	2,432,328.86	288,777.19	476.68	472.18	472.97	3.71	473.52	3.16
25	CT-68	2,432,661.05	288,603.54	476.74	471.83	472.59	4.15	473.15	3.59
26	CT-69	2,432,854.60	288,536.03	474.13	471.60	472.38	1.75	472.95	1.18
27	CT-70	2,433,106.82	288,447.68	477.39	471.31	472.16	5.23	472.71	4.68
28	CT-71	2,433,301.21	288,384.28	481.84	471.22	471.96	9.88	472.48	9.36
29	CT-72	2,433,455.57	288,265.39	481.31	470.97	471.80	9.51	472.27	9.04
30	CT-73	2,433,631.83	288,138.19	474.33	470.70	471.70	2.63	472.06	2.27
31	CT-74	2,433,708.50	288,101.65	473.11	470.65	471.67	1.44	471.98	1.13
32	CT-75	2,433,720.57	288,090.96	472.99	470.63	471.57	1.42	471.86	1.13
33	CT-76	2,433,727.86	288,082.80	472.89	470.60	471.47	1.42	471.73	1.16
34	CT-179	2,433,807.55	288,351.65	482.66	475.90	476.74	5.92	476.78	5.88

	Manhole ID	Coordinates Easting (X)	Coordinates Northing (Y)	Ground Elev.	Manhole Invert Elev.	Current (2020) Dry Weather Flows Maximum HGL Elev.	Current (2020) Dry Weather Flows Freeboard (Ft)	Current (2020) Wet Weather Flows Maximum HGL Elev.	Current (2020) Wet Weather Flows Freeboard (Ft)
DEMORY FARMS									
Demory Farms Minor Basin									
01	W3	2,441,747.34	295,183.40	442.87	432.58	432.72	10.15	432.81	10.06
02	W4	2,441,910.96	295,262.57	438.96	431.36	431.53	7.43	431.63	7.33
03	W5	2,442,043.85	294,987.94	435.03	428.22	428.42	6.61	428.54	6.49
04	W6	2,442,199.64	294,640.89	438.99	427.03	427.23	11.76	427.35	11.64
05	W7	2,442,355.03	294,294.73	439.05	425.76	425.95	13.10	426.06	12.99
06	W8	2,442,224.44	294,223.68	438.22	425.05	425.24	12.98	425.34	12.88
07	W9	2,442,171.20	293,936.60	437.47	423.80	423.98	13.49	424.09	13.38
08	DM-1	2,442,062.89	293,901.26	441.50	431.16	431.23	10.27	431.27	10.23
09	W10	2,442,122.53	293,948.02	439.10	430.17	430.23	8.87	430.27	8.83
Patrick Henry Minor Basin									
01	W1	2,441,739.80	295,615.20	454.51	438.83	438.97	15.54	439.06	15.45
02	W2	2,441,570.12	295,529.69	450.26	435.67	435.81	14.45	435.90	14.36
FLOWING SPRINGS									
Flowing Springs Minor Basin									
01	FSPS-2	2,438,773.64	299,527.44	454.62	438.08	438.55	16.07	438.54	16.08
02	FSPS-3	2,438,777.56	299,538.27	454.79	438.01	438.51	16.28	438.55	16.24
RANSON									
Old Leetown Pike Minor Basin									
01	R-1	2,431,442.20	299,314.61	558.82	551.00	551.00	7.82	551.00	7.82
02	R-3	2,431,488.41	299,072.29	556.20	551.38	551.50	4.70	551.58	4.62
03	R-2	2,431,442.97	299,077.13	557.75	550.12	550.24	7.51	550.32	7.43
04	R-4	2,431,447.41	298,782.21	547.30	542.15	542.27	5.03	542.35	4.95
05	R-6	2,431,450.16	298,671.43	544.40	540.58	540.70	3.70	540.78	3.62
06	R-7	2,431,451.04	298,397.28	539.50	535.14	535.29	4.21	535.39	4.11
R-68 Minor Basin									
07	R-24	2,431,455.44	298,120.48	534.00	530.50	530.65	3.35	530.75	3.25
08	R-23	2,431,456.99	298,035.73	532.29	529.43	529.58	2.71	529.68	2.61
09	R-22	2,431,455.78	297,978.10	531.44	528.68	528.83	2.61	528.93	2.51
10	R-21	2,431,453.37	297,757.77	528.65	525.88	526.03	2.62	526.13	2.52
11	R-19	2,431,449.86	297,605.52	527.23	523.00	523.19	4.04	523.31	3.92
12	R-25	2,431,447.09	297,408.16	526.24	517.00	517.19	9.05	517.31	8.93
13	R-67	2,431,552.99	297,400.37	522.61	516.10	516.32	6.29	516.48	6.13
14	R-68	2,431,514.26	297,283.95	520.95	515.58	515.79	5.16	515.92	5.03
15	R-128	2,431,511.46	296,770.60	514.49	506.07	506.34	8.15	506.51	7.98
16	R-129	2,431,514.44	296,546.83	514.18	505.52	505.79	8.39	505.97	8.21
17	R-130	2,431,510.98	296,170.69	517.28	504.66	504.89	12.39	505.03	12.25
18	R-131	2,431,513.64	296,113.79	517.88	504.40	504.69	13.19	504.87	13.01
19	R-132	2,431,456.89	296,106.62	517.84	504.30	504.56	13.28	504.73	13.11
20	R-137	2,431,321.58	296,093.49	514.95	503.93	504.22	10.73	504.39	10.56
21	R-138	2,431,324.72	296,009.58	512.27	503.83	504.07	8.20	504.21	8.06
22	R-139	2,431,416.88	295,796.98	515.36	503.16	503.41	11.95	503.56	11.80
23	R-141	2,431,551.24	295,537.91	513.62	502.44	502.69	10.93	502.84	10.78
24	R-142	2,431,444.54	295,491.81	516.31	502.16	502.36	13.95	502.48	13.83
25	R-143	2,431,534.84	295,216.08	508.12	499.92	500.14	7.98	500.27	7.85
26	R-144	2,431,553.74	295,167.18	507.12	499.71	499.91	7.21	500.03	7.09
27	R-148	2,431,476.05	295,128.46	506.94	498.52	498.72	8.22	498.84	8.10
28	R-149	2,431,151.47	294,979.23	502.68	495.09	495.38	7.30	495.56	7.12

		Coordinates				Current (2020) Dry Weather Flows		Current (2020) Wet Weather Flows	
	Manhole ID	Easting (X)	Northing (Y)	Ground Elev.	Manhole Invert Elev.	Maximum HGL Elev.	Freeboard (Ft)	Maximum HGL Elev.	Freeboard (Ft)
R-151 Minor Basin									
29	R-150	2,431,260.49	294,743.26	500.09	494.43	494.72	5.37	494.91	5.18
30	R-151	2,431,381.34	294,459.02	502.97	493.69	494.12	8.85	494.48	8.49
31	R-232	2,431,096.75	294,319.88	496.92	492.88	493.31	3.61	493.67	3.25
32	R-233	2,430,974.54	294,262.50	499.85	492.54	492.97	6.88	493.34	6.51
33	R-234	2,430,988.97	294,087.30	497.02	492.10	492.53	4.49	492.89	4.13
34	R-235	2,431,002.84	293,738.11	498.01	491.22	491.66	6.35	492.02	5.99
35	R-236	2,430,692.73	293,727.28	493.78	490.46	490.89	2.89	491.26	2.52
36	R-241	2,430,707.82	293,366.75	492.95	489.56	489.99	2.96	490.38	2.57
37	R-242	2,430,708.10	293,167.48	493.09	489.06	489.51	3.58	489.95	3.14
38	R-246	2,430,712.03	293,008.40	493.64	488.70	489.17	4.47	489.62	4.02
39	R-247	2,430,994.17	293,011.61	493.94	488.19	488.62	5.32	488.98	4.96
40	R-249	2,431,011.91	292,670.24	496.64	487.33	487.68	8.96	487.89	8.75
41	R-250	2,431,009.04	292,516.98	493.90	485.93	486.36	7.54	486.68	7.22
42	R-251	2,430,931.83	292,499.77	492.01	485.71	486.23	5.78	486.46	5.55
43	R-252	2,430,932.92	292,514.27	494.35	485.90	486.28	8.07	486.38	7.97
44	R-259	2,430,933.81	292,428.53	496.62	485.44	485.98	10.64	486.23	10.39
SAMUEL STREET									
CT-185 Minor Basin									
01	CT-235	2,435,243.35	289,871.90	492.58	484.56	484.89	7.69	485.05	7.53
02	CT-236	2,435,193.43	289,758.34	481.81	475.80	476.13	5.68	476.30	5.51
03	CT-237	2,435,053.40	289,363.21	477.29	472.90	473.22	4.07	473.37	3.92
04	CT-238	2,434,967.42	289,067.08	472.11	469.70	470.06	2.05	470.56	1.55
05	CT-243	2,434,924.60	288,682.32	487.43	468.20	468.67	18.76	469.61	17.82
06	CT-244	2,434,846.68	288,477.30	469.13	467.80	468.10	1.03	469.13	-
07	CT-245	2,434,823.49	288,239.59	469.36	466.10	466.47	2.89	469.36	-
08	CT-246	2,434,956.21	288,152.07	473.93	465.60	465.93	8.00	469.57	4.36
09	CT-185	2,434,771.03	288,076.11	469.17	464.70	465.06	4.11	469.17	-
10	CT-186	2,434,882.90	287,821.33	469.54	463.90	464.25	5.29	469.54	-
11	CT-187	2,434,874.93	287,720.66	469.58	463.58	463.93	5.65	469.58	-
Race Track Minor Basin									
01	JC-14	2,437,414.05	296,554.35	521.41	519.00	519.00	2.41	519.00	2.41
02	JC-13	2,437,331.22	296,411.60	519.66	514.80	514.80	4.86	514.80	4.86
03	JC-12	2,437,261.61	296,302.50	515.50	511.00	511.00	4.50	511.00	4.50
04	JC-11	2,437,032.64	296,141.97	503.75	500.00	500.00	3.75	500.00	3.75
05	JC-9	2,436,898.74	296,045.09	501.98	493.00	493.00	8.98	493.00	8.98
06	JC-10	2,436,909.71	296,031.88	502.85	492.79	492.91	9.94	492.98	9.87
Wendy's Minor Basin									
07	CT-365	2,436,190.67	293,357.41	504.24	501.50	501.70	2.54	501.83	2.41
08	CT-364	2,436,006.11	293,251.57	506.37	500.90	501.06	5.31	501.15	5.22
09	CT-363	2,436,051.56	293,149.84	507.30	499.75	499.94	7.36	500.04	7.26
10	CT-362	2,436,068.21	292,892.82	505.58	498.80	498.97	6.61	499.06	6.52
11	CT-359	2,436,078.41	292,715.71	509.22	497.75	497.91	11.31	497.99	11.23
12	CT-282	2,435,914.52	292,706.54	508.77	497.10	497.24	11.53	497.31	11.46
13	CT-281	2,435,906.82	292,706.22	508.72	497.00	497.14	11.58	497.21	11.51
14	CT-279	2,435,875.03	292,704.91	509.00	496.50	496.66	12.34	496.74	12.26
15	CT-278	2,435,705.70	292,696.66	511.82	495.85	496.25	15.57	496.25	15.57

	Manhole ID	Coordinates Easting (X)	Northing (Y)	Ground Elev.	Manhole Invert Elev.	Current (2020) Dry Weather Flows Maximum HGL Elev.	Freeboard (Ft)	Current (2020) Wet Weather Flows Maximum HGL Elev.	Freeboard (Ft)
CT-293 Minor Basin									
16	CT-339	2,436,132.72	291,721.60	535.94	533.00	533.22	2.72	533.33	2.61
17	CT-338	2,436,153.64	291,383.70	531.11	528.25	528.50	2.61	528.62	2.49
18	CT-337	2,436,164.08	291,141.76	536.52	527.28	527.52	9.00	527.63	8.89
19	CT-336	2,436,173.10	290,905.66	531.09	526.05	526.29	4.80	526.40	4.69
20	CT-294	2,435,951.54	290,949.37	537.47	525.11	525.34	12.13	525.45	12.02
21	CT-293	2,435,794.46	290,973.73	535.84	524.40	524.62	11.22	524.73	11.11
CT-300 Minor Basin									
22	CT-297	2,435,704.56	290,563.52	534.76	521.80	522.03	12.73	522.16	12.60
23	CT-298	2,435,650.19	290,336.68	530.50	520.62	520.85	9.65	520.98	9.52
24	CT-299	2,435,590.68	290,094.77	526.73	519.37	519.59	7.14	519.73	7.00
25	CT-300	2,435,525.50	289,870.75	522.38	518.20	518.43	3.95	518.56	3.82
CT-305 Minor Basin									
26	CT-301	2,435,490.38	289,687.01	521.12	517.20	517.40	3.72	517.52	3.60
27	CT-302	2,435,432.74	289,472.03	520.71	515.35	515.55	5.16	515.67	5.04
28	CT-303	2,435,350.69	289,070.22	513.73	507.85	508.05	5.68	508.17	5.56
29	CT-304	2,435,325.21	288,899.92	511.91	506.07	506.36	5.55	506.55	5.36
30	CT-305	2,435,286.31	288,629.22	512.50	505.42	505.65	6.85	505.79	6.71
CT-313 Minor Basin									
31	CT-307	2,435,253.43	288,448.58	511.28	504.47	504.68	6.60	504.80	6.48
32	CT-306	2,435,230.21	288,424.22	509.51	502.25	502.46	7.05	502.58	6.93
33	CT-308	2,435,211.88	288,339.72	505.79	498.00	498.21	7.58	498.33	7.46
34	CT-309	2,435,167.95	288,179.10	502.13	496.52	496.73	5.40	496.85	5.28
35	CT-310	2,435,143.07	288,041.97	497.71	491.19	491.40	6.31	491.52	6.19
36	CT-311	2,435,086.55	287,844.34	489.85	474.00	474.22	15.63	474.34	15.51
37	CT-312	2,434,986.46	287,807.27	471.86	467.00	467.22	4.64	468.68	3.18
38	CT-313	2,434,920.64	287,784.37	468.63	464.00	464.27	4.36	468.63	-
39	CT-314	2,434,885.28	287,712.30	469.78	463.50	463.89	5.89	469.78	-
WILLOW SPRING									
Willow Spring Minor Basin									
01	DF1	2,439,750.60	293,655.97	457.70	450.38	450.72	6.98	450.77	6.93
02	DF2	2,439,722.70	293,560.20	454.49	446.95	447.29	7.20	447.34	7.15
03	DF3	2,439,689.77	293,532.76	451.48	445.62	445.99	5.49	446.05	5.43
04	DF4	2,439,614.36	293,368.30	450.64	444.77	445.08	5.56	445.14	5.50
05	CT-473	2,439,496.03	293,110.23	447.01	442.01	442.31	4.70	442.39	4.62
06	CT-474	2,439,383.56	292,862.37	446.84	440.57	440.91	5.93	441.02	5.82
07	DF7	2,439,154.01	292,918.09	448.53	439.87	440.11	8.42	440.21	8.32
08	CT-463	2,439,037.30	292,946.41	441.22	432.13	432.37	8.85	432.48	8.74
09	CT-462	2,438,909.08	292,805.62	441.70	430.34	430.79	10.91	431.01	10.69
10	WS2	2,438,848.88	292,649.41	442.23	430.06	430.33	11.90	430.46	11.77

INTRODUCTION

Charles Town Utility Board (CTUB) Staff has noted that sanitary sewer manholes are experiencing concrete deterioration within two known problem areas. The two areas in question include the "bottleneck" along the Evitt's Run Interceptor near the Flowing Springs Pump Station discharge and the Brownville Lane area. At the request of the CTUB, RK&K inspected 65 sanitary sewer manholes in these known problem areas.

The concrete deterioration shown in the sanitary sewer manholes can be attributed to hydrogen sulfide. Hydrogen sulfide is common in sewers with flat slopes, low wastewater velocities, and long detention times, especially in force mains and their discharges. Over time, hydrogen sulfide eats away at the walls of manholes, which leads to corrosion, leaks, groundwater intrusion, exposed rebar, and weakened structure strength.

In addition to concrete deterioration from hydrogen sulfide, inflow and infiltration (I&I) can also become an issue in sewer systems. I&I is the result of excess storm water and groundwater entering the sewer system. Without proper remediation of I&I, costs to pump the excess water as well as treatment costs could increase.

FINDINGS

Overall Rating

During the inspection process, manholes were rated on a 1 to 5 scale: 1 being good condition and 5 being poor condition. Ratings were assigned on the significance of the defects, extent of damage, or amount of wall loss due to deterioration. Ratings and definitions are listed below:

5 – Most significant defect grade
4 – Significant defect grade
3 – Moderate defect grade
2 – Minor to moderate defect grade
1 – Minor or no defect grade

Of the 65 manholes inspected:

- 18 were rated as 5
- 13 were rated as 4
- 13 were rated as 3
- 15 were rated as 2
- 6 were rated as 1

Manholes with a rating of 5 and 4 require immediate attention, and manholes with a rating of 3 will soon require attention. As shown in the Figure on the following page, manholes in worse condition were closer to force main discharges.

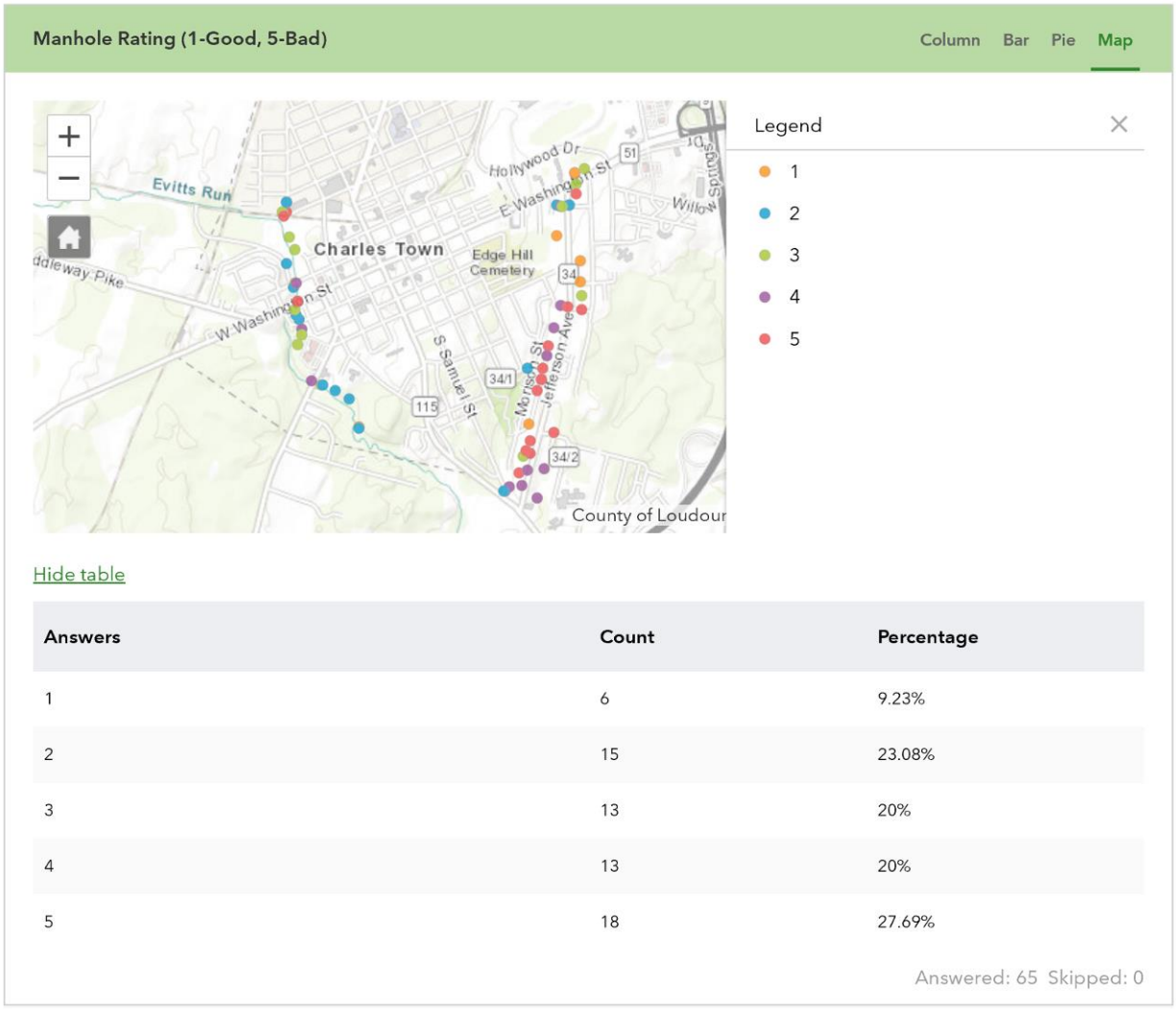


Figure 1 – Manhole Rating

Inflow and Infiltration

During inspections, any indications of inflow or infiltration are typically noted. However, due to the high amount of concrete deterioration in most of the manholes, it was difficult to note any instances of inflow or infiltration.

Miscellaneous Issues

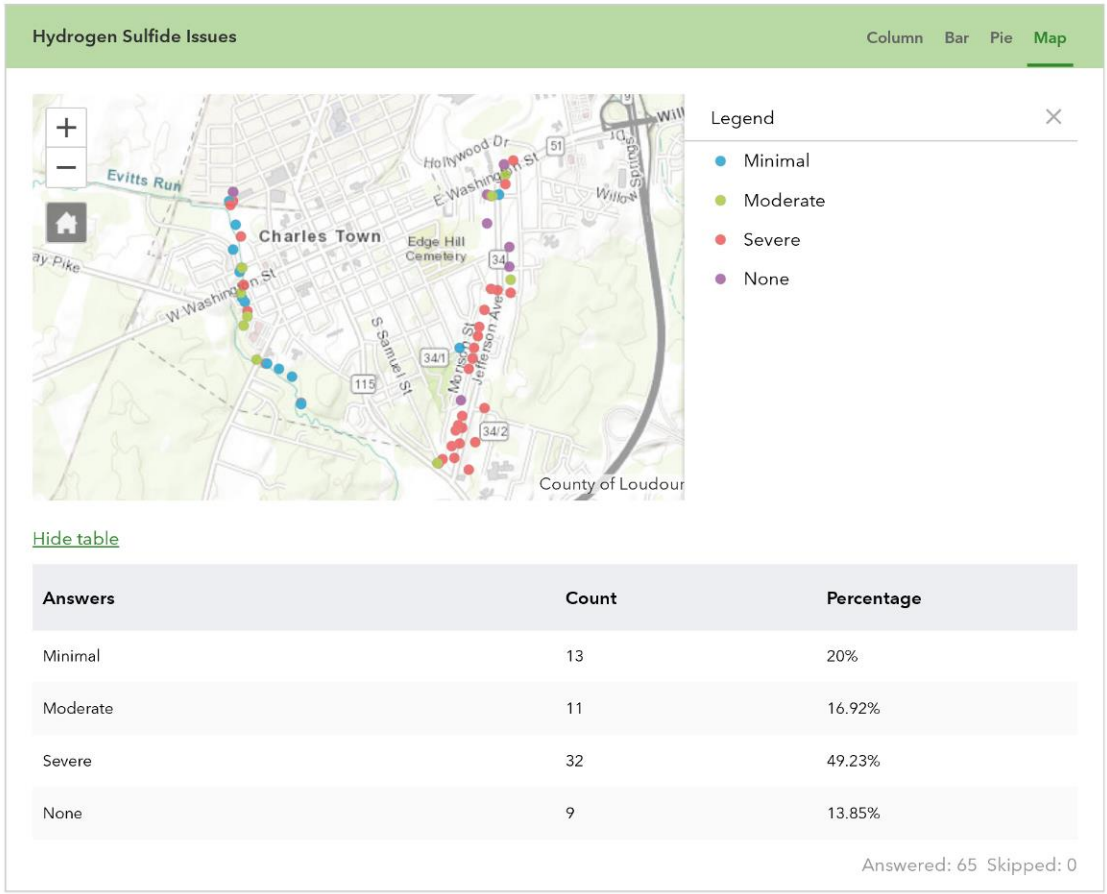
Of the manholes inspected, three (3) were buried under pavement and three (3) were buried under gravel. These manholes will also need risers to bring them up to grade to allow access. Of the manholes inspected, thirty-six (36) had bolted frame and covers with six (6) bolts. Discussions with Charles Town Operators and Staff have indicated that maintaining these manholes is more difficult because access is harder and standard risers cannot be used with these frames. These frames and covers exist throughout the former City of Charles Town Sewer System.



Figure 2 Six-Bolt Covers and Buried Manholes (typ)

Hydrogen Sulfide Issues

During inspections, concrete deterioration from hydrogen sulfide was the most commonly observed issue, as shown in the photos on the following page. More severe hydrogen sulfide conditions were seen closer to force main discharges, with conditions improved downstream, as shown in Figure 5 below.



Answers	Count	Percentage
Minimal	13	20%
Moderate	11	16.92%
Severe	32	49.23%
None	9	13.85%

Answered: 65 Skipped: 0

Figure 3 Hydrogen Sulfide Issues



Figure 4 Concrete Deterioration from Hydrogen Sulfide

RECOMMENDATIONS

Manhole Rehabilitation

RK&K's recommendations for rehabilitation and maintenance include epoxy coating, cement coating/repairs, standard manhole cover/frame installation, manhole replacement, repair bench/invert, reset existing frame and cover, flush/jet main, install riser, and install drop connection.

Various manholes inspected were noted as already being lined. Most of these manholes were lined by PolyCoating Solutions with products specified in an attachment to this report, and the lining is withstanding the hydrogen sulfide. One of these manholes is MH R-251 which was lined by Ranson using unknown products. This lining is not withstanding the hydrogen sulfide. Because of this, RK&K recommends that CTUB continues to utilize PolyCoating Solutions for the manhole lining. Cost estimates for lining are based on utilization and application of these products by PolyCoating Solutions.

The capacity of the sewer line from MH R-252 to MH CT-67 was briefly analyzed utilizing the Sewer Model from Task 05 with current peak dry weather flow conditions. The Model indicated that at current peak conditions, no segments of pipe were surcharged and the maximum depth in all segments is 48.3 percent. Based on these results, it does not appear necessary to increase the capacity of the lines at this time, so lining is recommended.

Cost estimates for rehabilitation are included in the cost estimates attached. Cost estimates have been broken into levels based on severity. Note that bypass pumping will be required for manhole lining, and bypass pumping cost is not included in the cost estimates.

	Cost
Level 5 Manholes (18)	$81,420
Level 4 Manholes (13)	$47,980
Level 3 Manholes (13)	$46,070
Level 2 Manholes (15)	$26,070
Level 1 Manholes (6)	$620
Total	$202,160

Further Manhole Inspection

The Charles Town Utility Board (CTUB) sewer system consists of three separate systems that were combined: the Jefferson County PSD system, the City of Charles Town system, and the City of Ranson system. Within this system, there are 45 pump stations. As described above, hydrogen sulfide issues were discovered at the force main discharges from the Flowing Springs, Race Track, Wendy's, Clarence Drive, and former Euclid Avenue pump stations included in this task. RK&K also inspected the discharge manholes from the Belvedere Heights and County Green Pump Stations and found severe hydrogen sulfide issues in these locations. It is assumed that all pump station discharge manholes within the system may also be experiencing concrete deterioration from hydrogen sulfide. Based on the inspections described above, it is estimated that most hydrogen sulfide deterioration occurs within four manholes of each pump station discharge. RK&K is recommending inspections of the discharge manhole and subsequent 4 manholes for the remaining 40 pump station discharges in the system. RK&K has submitted a Scope of Work Change to CTUB Staff for $27,100 for inspection of these manholes.

Replace Existing Manhole	MH ID	Depth (feet)	Cost
	R-251	6.4	$ 4,450
	CT-364	6.33	$ 4,450
	CT-336	5.8	$ 4,000
		Replace Existing Manhole Subtotal	$ 12,900
Apply Interior Coating (Epoxy)	MH ID	Depth (feet)	Cost
	CT-423	11.2	$ 5,320
	CT-43	9.4	$ 4,470
	R-251	6.4	$ 3,040
	CT-364	6.33	$ 3,010
	CT-298	7.3	$ 3,470
	CT-336	5.8	$ 2,760
	CT-362	9.9	$ 4,710
	CT-305	7	$ 3,330
	CT-310	5.1	$ 2,430
	CT-327	6.6	$ 3,140
	R-259	10.5	$ 4,990
	CT-306	4.6	$ 2,190
	CT-307	6.2	$ 2,950
	CT-294	13.4	$ 6,370
	CT-303	6	$ 2,850
	CT-302	6.3	$ 3,000
	CT-301	4.5	$ 2,140
	CT-300	4.9	$ 2,330
	CT-48	5.8	$ 2,760
	CT-39	8.1	$ 3,850
	CT-299	6.7	$ 3,190
	CT-313	5	$ 2,380
	CT-312	4.8	$ 2,280
	CT-325	5	$ 2,380
	CT-323	4.9	$ 2,330
	CT-57	5.8	$ 2,760
	CT-311	4.9	$ 2,330
	CT-309	5.5	$ 2,620
	CT-359	12.4	$ 5,890
	CT-293	12.8	$ 6,080
	CT-297	11	$ 5,230
	CT-49	7.6	$ 3,610
	CT-50	4.4	$ 2,090
	CT-45	7.3	$ 3,470
	CT-41	9.2	$ 4,370
	CT-365	3.3	$ 1,570
	CT-363	9.3	$ 4,420
	CT-308	4.2	$ 2,000
	CT-59A	5.7	$ 2,710
	CT-3	7.1	$ 3,380
	CT-2	7.1	$ 3,380
	CT-279	13.6	$ 6,460
	CT-337	9.9	$ 4,710
	CT-46	6.2	$ 2,950
	CT-42	4.5	$ 2,140
	CT-235	7	$ 3,330
	CT-314	7.1	$ 3,380
	CT-67	7.5	$ 3,570
	CT-65	6.25	$ 2,970
	CT-64	6.9	$ 3,280
	CT-59A	6.8	$ 3,230

		Apply Interior Coating (Epoxy) Subtotal	$ 173,600
Apply Interior Coating (Cement)	MH ID		Cost
	CT-282	13	$ 100
		Apply Interior Coating (Cement) Subtotal	$ 100
Install New Standard Frame and Cover	MH ID		Cost
	CT-305		$ 310
	CT-306		$ 310
	CT-307		$ 310
	CT-294		$ 310
	CT-303		$ 310
	CT-302		$ 310
	CT-301		$ 310
	CT-300		$ 310
	CT-364		$ 310
	CT-336		$ 310
	CT-310		$ 310
	CT-327		$ 310
	CT-311		$ 310
	CT-309		$ 310
	CT-359		$ 310
	CT-293		$ 310
	CT-297		$ 310
	CT-299		$ 310
	CT-313		$ 310
	CT-312		$ 310
	CT-323		$ 310
	CT-325		$ 310
	CT-50		$ 310
	R-252		$ 310
	CT-3		$ 310
	CT-2		$ 310
	CT-279		$ 310
	CT-337		$ 310
	CT-365		$ 310
	CT-363		$ 310
	CT-308		$ 310
	CT-59A		$ 310
	CT-282		$ 310
	CT-281		$ 310
	CT-364A		$ 310
	CT-285		$ 310
		Install New Standard Frame and Cover Subtotal	$ 11,160
Repair Bench and/or Invert	MH ID		Cost
	CT-423		$ 500
	CT-303		$ 500
	CT-48		$ 500
	CT-3		$ 500
	CT-47		$ 500
		Repair Bench and/or Invert Subtotal	$ 2,500
Reset Existing Frame and Cover	MH ID		Cost
	CT-57		$ -
		Reset Existing Frame and Cover Subtotal	$ -
Flush/Jet Main	MH ID		Cost

	CT-364		$ -
	CT-279		$ -
	R-249		$ -
		Flush/Jet Main Subtotal	$ -
Install Drop Connection	MH ID		Cost
	CT-327		$ 100
		Install Drop Connection Subtotal	$ 100
Install Riser	MH ID	Height (in.)	Cost
	CT-303	7.5	$ 300
	CT-302	8.5	$ 300
	CT-301	9.5	$ 300
	CT-300	5	$ 300
	CT-359	7	$ 300
	CT-279	4	$ 300
		Install Riser Subtotal	$ 1,800
		TOTAL COST	**$ 202,160**
		LEVEL 5 COST	**$ 81,420**
		LEVEL 4 COST	**$ 47,980**
		LEVEL 3 COST	**$ 46,070**
		LEVEL 2 COST	**$ 26,070**
		LEVEL 1 COST	**$ 620**
		***Bypass Pumping Cost Not Included**	

CHARLES TOWN UTILITY BOARD
WATER/SEWER SYSTEMS UPGRADE PROJECTS

RUMMEL, KLEPPER & KAHL, LLP

TASK NO. 14
SCOPE OF WORK CHANGE NO. 01

PROFESSIONAL ENGINEERING & SURVEYING SERVICES

MANHOLE EVALUATION

October 19, 2020

Being a part of Agreement Between
Charles Town Utility Board and Rummel, Klepper & Kahl, LLP
dated November 13, 2019

This Scope of Work Change No 01. to Task No. 14 dated October 19, 2020 to the Agreement between Charles Town utility Board (CTUB) and Rummel, Klepper, and Kahl, LLP (RK&K) dated November 13, 2019 is to provide professional engineering services for assisting with the evaluation of sanitary sewer manholes that are experiencing concrete deterioration in the vicinity of 40 pump station force main discharges. Based on previous inspections of 55 manholes, it is approximated that the majority of the problems occur within four manholes downstream from each discharge manhole.

Scope of Services

The following summarizes RK&K's services as part of this Task:

1. Based on CTUB's existing GIS system and pump station list, approximately 200 manholes (40 pump stations x 5 manholes) are estimated to be included in the evaluation, contingent on how severe the hydrogen sulfide issues found are. Ten (10) days of field review are anticipated.

2. RK&K will use a GIS form for inspections of manholes utilizing CTUB's existing GIS system. The GIS form will include information such as manhole condition, I&I analysis, invert dimensions, depth of manhole, photos, and recommendations.

3. RK&K will inspect each pump station discharge manhole and the manholes downstream from each pump station listed on CTUB's pump station spreadsheet.

    a. Inspections were previously conducted on manholes for the Flowing Spring Pump Station, former Euclid Pump Station, Clarence Drive Pump Station, Racetrack Pump Station, and Wendy's Pump Station and are excluded in this Scope of Work Change to avoid duplication of efforts.

4. RK&K will prepare a report summarizing findings and recommendations for rehabilitating the issues found.

5. RK&K will give the collected GIS data to CTUB Staff to add to their current GIS system.

6. RK&K will meet with CTUB Staff to present findings and recommendations.

7. RK&K will submit a Scope of Work Change to this Task Order for assistance with construction phase services for implementing rehabilitation efforts identified within the report such as sequencing during construction for any manhole replacements, if needed.

Schedule

RK&K anticipates 90 working days to perform the manhole inspections and prepare report from notice to proceed.

Estimated Person-Hours per Phase by Category, Engineer's Consultant Costs and Other Direct Costs

A fee derivation is attached as Page 4 which includes RK&K's estimated person-hours per Phase by category and other direct costs anticipated to complete the work for this project.

Materials and Resources Required of CTUB

- CTUB will be responsible for providing access to the manholes to be inspected.
- CTUB will be responsible for any and all construction related materials and equipment.

Estimated Not-To-Exceed Fee

RK&K will provide the scope of services described above at an amount equal to Engineer's Direct Labor Costs times a factor of 2.7 for the services of Engineer's personnel engaged on the Project, plus Reimbursable Expenses. RK&K's current certified payrates for personnel to be assigned to this project is included as Exhibit B to Original Agreement dated November 13, 2019. RK&K's fee is based on CTUB personnel doing the construction activity.

The total estimated Not-to-Exceed fee to perform the work is $27,100.00 as shown on RK&K's enclosed fee derivation.

Authorization

This Scope of Work Change No. 01 to Task No. 14, Manhole Evaluation, dated October 19, 2020 and being a part of the Agreement between Charles Town Utility Board and Rummel, Klepper & Kahl, LLP for Engineering Services for Water/Sewer Systems Upgrade Projects dated November 13, 2019, is approved by the following duly authorized officials:

Engineer: RUMMEL, KLEPPER & KAHL, LLP

_____ 10/19/2020

John W. Cole, PE — Date
Manager, Municipal Engineering

Owner: Charles Town Utility Board

_____ _____

Daryl Hennessy — Date
Chairman

RUMMEL, KLEPPER KAHL, LLP
FEE DERIVATION
CHARLES TOWN UTILITY BOARD
TASK 14
SCOPE OF WORK CHANGE NO. 01
MANHOLE EVALUATION

October 19, 2020

Scope of Services	Manager	Engineer / Associate Engineer	Designer	GIS Analysis	Misc. Exp.	Task Total Hours
Technical Assistance						
Meeting	2	2				**4**
MH Inspection		120	120		$ 450.00	**240**
Summary of Findings	1	8	4	6		**19**
Total Hours	**3**	**130**	**124**	**6**	**$ 450.00**	**263**
Hourly Rate (including 2.7 multiplier)	**$ 210.00**	**$ 104.00**	**$ 95.00**	**$ 120.00**		
Total Fee	**$ 630.00**	**$ 13,520.00**	**$ 11,780.00**	**$ 720.00**	**$ 450.00**	**$ 27,100.00**

NTE Cost	**$ 27,100.00**

Gannett Fleming

Excellence Delivered ***As Promised***

January 12, 2021

Via email to ashultz@ctubwv.com

Ms. April Shultz
Assistant Utility Manager
Charles Town Utility Board
661 S. George Street, Ste. 101
Charles Town, WV 25414

Dear Ms. Shultz:

Wastewater Cost of Service and Rate Study

Thank you for the opportunity to submit this proposal to conduct a wastewater rate study for the Charles Town Utility Board (the Board). The proposal outlines our qualifications and experience, the scope of services we plan to provide and an estimate of our fees to complete the assignment.

QUALIFICATIONS AND EXPERIENCE

Gannett Fleming Valuation and Rate Consultants, LLC has a wealth of experience conducting rate studies for privately-owned and municipally-owned water and wastewater utilities. Our practice specializes in all areas of ratemaking required for this assignment including cost of service, and the development of sound, defensible wastewater rates and charges. The project manager, Constance Heppenstall, has over 14 years of experience conducting rate studies for water and wastewater utilities for municipal entities.

SCOPE OF SERVICES

We understand the Board requires a rate study to determine the appropriate level of rates and charges for the wastewater systems. Revenues will be projected under existing rates and compared to the projected revenue requirements to determine to what extent rates will need to be increased or revised.

In order to perform an accurate cost of service study, we will perform a detailed bill analysis for the most recent 12 months of the Board's wastewater bills to determine the usage at each consumption level by class. This data will be inputs for the cost of service study and provide the basis for rate design. Our estimate of costs assumes that the billing data is relatively in line with revenue booked.

Gannett Fleming Valuation and Rate Consultants, LLC
1010 Adams Avenue •Audubon, PA 19403-2402
t: 610.650.8101 • f: 610.650.8190
www.gfvrc.com

We will work with the Board to determine the revenue requirements to be used as a foundation for the cost of service study. The revenue requirement will be developed under a cash basis, which includes the operation and maintenance expense, debt service and any coverage requirements and an allowance for renewals and replacements.

The wastewater cost of service study will be based on a functional cost allocation methodology discussed in the text “Financing and Charges for Wastewater Systems”, Manual of Practice No. 27, published by the Water Environment Federation. Our team has used this method in cases before many state public utility commissions and is a widely-accepted method of cost allocation.

Rates will be designed to recover the projected cost of service commensurate with the allocated costs for the entire service area. The results of the rate study will produce a sound and defensible rate schedule. We understand that the Board currently has three different rate districts - Charles Town, the City of Ranson and the Jefferson County Public Service District. In order to implement and evaluate single tariff pricing, we will present three rate consolidation options to the Board, including evaluating the overall rate structure. As part of the analysis, we will show bill comparisons at various usage levels to show the impact of the revised rate structure on the various customer classes.

The results of the rate study will be summarized in a written report and presented virtually at a meeting of the Board. Due to the COVID-19 pandemic, our scope does not include any travel related costs as we plan on attending meetings virtually.

ESTIMATE OF FEES

Gannett Fleming proposes to complete the scope of work on the basis of hourly billing rates for our personnel, plus reimbursement of direct expenses. The time to complete studies of this nature can vary depending on the availability of basic data and the assistance provided by utility personnel. Based on our experience conducting similar assignments, we estimate that the charges will not exceed $30,000 without prior approval from the Board.

This total assumes that the Board’s billing data is inline with revenues booked and includes no travel related expenses.

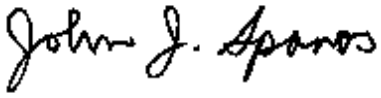
This estimate excludes any costs subsequent to the completion of the assignment, such as the time required to respond to parties under adverse intervention.

If the foregoing proposal is acceptable, please have it executed below by an authorized official of the Board and email a copy to Cheryl Rutter, CPS, Administrator, at crutter@gfnet.com with a copy to Constance E. Heppenstall at cheppenstall@gfnet.com.

Thank you for the opportunity to submit this proposal for your consideration. Please reach out to Connie either via email at cheppenstall@gfnet.com or by phone at 610-783-3785 if you have any questions or comments.

Respectfully submitted,

GANNETT FLEMING VALUATION
AND RATE CONSULTANTS, LLC



JOHN J. SPANOS
President



CONSTANCE E. HEPPENSTALL
Senior Project Manager, Rate Studies

The Charles Town Utility Board accepts the foregoing Proposal and authorizes Gannett Fleming Valuation and Rate Consultants, LLC to proceed with the services described herein.

ACCEPTED BY:

_____ _____
(Name) (Printed Name)

_____ _____
(Title) (Date)

GANNETT FLEMING VALUATION AND RATE CONSULTANTS, LLC

BILLING RATES

Personnel	Hourly Rate
SUPERVISORY STAFF	
J. J. Spanos, President	$285.00
H. Walker, III, Manager, Financial Studies	260.00
J. F. Wiedmayer, Jr., Project Manager, Depreciation	240.00
N. W. Allis, Vice President	240.00
C. E. Heppenstall, Senior Project Manager, Rate Studies	240.00
STAFF	
Analysts	180.00
Associate Analysts	170.00
Assistant Analysts III	160.00
Assistant Analysts II	130.00
Assistant Analysts I	120.00
Senior Technicians	120.00
Support Staff	120.00

Charles Town
Utility Board
661 S. George Street, Suite 101 Charles Town, WV 25414
Phone: (304) 725-2316 ♦ Fax: (304) 725-7150 ♦ Web: www.ctubwv.com

CAPACITY IMPROVEMENT FEE ANALYSIS SCHEDULE

In addition to rate equalization of the water and sewer billing rates (post consolidation), there are several items in the water and sewer tariffs that need to be addressed by CTUB. Specifically, there have been questions about the Capacity Improvement Fee (CIF) calculation assessments as well as the charges of the CIF's.

There are several steps that need to be taken to address the questions on the CIF's. A forecasted timeline for each item can be found below:

Spring 2021 -	Complete Sewer Model and evaluate recommendations
Spring/Summer 2021 -	Initiate 10-year Capital Improvement plan and incorporate
Summer/Fall 2021-	Complete all items on Attachment C (included in Board Packet)
Winter 2021-2022-	Dewberry to initiate and complete Capacity Fee Evaluation
Spring 2022-	City Council review/adoption of recommended changes to CIF's

The Capacity Fee Evaluation by Dewberry will utilize all items in Attachment C and will produce recommendations for residential, commercial and industrial CIF's.

In addition to the above items, the CTUB Board of Directors should provide guidance on the CIF calculation assessments detailed in Schedule II of the CTUB Sewer Tariff.

Attachment C

Checklist of Information Needed from CTUB for Water and Wastewater Capacity Improvement Fee Studies

Item	Description	Water CIF	WW CIF	Date Provided	Notes
1	A Listing of Prior Capacity-Related Projects, their Year Completed, their total Cost. Generally look back about 15 years.	◆	◆		
2	A Listing of New Capacity Related Projects for the next 10 years and the planned year of implementation for each.	◆	◆		We can discuss timing of projects to balance out your CIP and bond issuances.
3	The Current Flow per Equivalent (Residential) Dwelling Unit (EDUs) for each water and sewer (usually 150-350 gpd)	◆	◆		May be determine using sum of annual usage for all residential customers divided by number of residential customers. Other methods can also be used such as what WVDEP or WVDHHR BPH uses for water and sewer.
4	The Rated Capacity and Current Average Daily Flow Rate for each Wastewater Plant		◆		
5	The Rated Capacity and Current Average Daily Demand for each Water Plant.	◆			
6	Original Principal Amount for Bond Issuances, Repayment Period, Interest Rate, Start-Date (should correspond with list under Item 1). If any portion of bonds were paid off faster for some reason, also provide the current balance.	◆	◆		
7	Projected new EDUs for each water and sewer to be connected to the system each year.	◆	◆		Needed for debt principal credit calculation.
8	Current Number of EDUs connected for each water and sewer.	◆	◆		May be determined using total usage for all customers divided by the flow per EDU determined under Item 3.
9	The projected interest rate for the account that the CIF payments will be depositd into.	◆	◆		Typically 1-1.5%.
10	The projected interest rate for future bonds and the repayment period.	◆	◆		
11	Information on Prior CIF Studies.	◆	◆		
12	Basis for CIF Charges: Meter-Size, Fixture Units (not recommended) or Flow-Projections by Development Type (WVDEP approach).	◆	◆		We can discuss pros and cons of each method and decide later.
13	Agreement on Growth Related Percentages for each Project Listed under Items 1 and 2.	◆	◆		We usually work this out together based on capacity or other metrics.
14	Agreement on Useful Life for each type of project (e.g., 30 years for plants, 50 years for pipelines, 20 years for pump stations).	◆	◆		Needed for deprication of historical projects.
15	Year you want the CIF to be effective (2019 or 2020).	◆	◆		
16	Water loss percentage for Water	◆			Analyzed by comparing Water Production with Water Billing Records.
17					
18					
19					
20					
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24					
25					
26					