GROTON UTILITIES

At Your Service

December 4, 2023

Connecticut Department of Public Health
Drinking Water Section
Attention: Mr. Isaac Quansah
410 Capitol Avenue, MS# 12DWS
P.O. Box 340308
Hartford, CT 06134-0308

Re: 2023 – Stage 2 DBPR Operational Evaluation Level Report, 3rd Quarter
LWPCA Ledyard Center PWSID # CT0727091

Dear Mr. Quansah,

As required, Ledyard Center OEL Evaluation for site #LC117 11 Village Dr. for 2022, 1st quarter is submitted.

If you have any questions, please feel free to contact me at (860) 446-4080 or dietrichs@grotonutilities.com .

GROTON UTILITIES

Stephen Dietrich

Stephen Dietrich
Groton Utilities, Water Quality Manager

Attachments (4)

295 Meridian Street
Groton, Connecticut 06340
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State of Connecticut
Department of Public Health
Drinking Water Section

Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) Operational Evaluation Reporting Form

I. General Information

A. Public Water System (PWS) Information **B. Date Prepared:** 12/4/23

PWSID: CT0727091

PWS Name: LWPCA Ledyard Center

Population Served: 3,294

System Type	Primary Source Water Type	Buying/Selling Relationships
☒ CWS ☐ NTNC	☒ Surface Water or Ground Water Under the Direct Influence of Surface Water (Subpart H) ☐ Ground Water	☒ Consecutive System ☐ Wholesale System ☐ Neither

C. Contact Person

Name: Honorable Fred Allyn III

Mailing Address: 741 Colonel Ledyard Highway

City/Town: Ledyard State: CT Zip Code: 06339-1511

Title: Mayor

Business Phone #: 860-464-3222 Ext: _____ Fax #: 860-464-8455

E-mail: mayor@ledyardct.org

II. Compliance Information

A. Compliance Period of OEL Exceedance(s): 3rd quarter 2023

B. Number of monitoring sites that exceeded the TTHM OEL: 1

C. Number of monitoring sites that exceeded the HAA5 OEL: 0

D. Has an OEL exceedance occurred at these monitoring sites in the past? ☒ Yes ☐ No

E. Was the cause determined for the previous exceedances? ☐ Yes ☒ No

F. Are the previous evaluations/determinations applicable to the current OEL exceedance? ☒ Yes ☐ No

G. Did the State allow you to limit the scope of the operational evaluation? ☐ Yes ☒ No
If yes, attach written correspondence from the State.

III. Monitoring Results

Summarize the results of the Operational Evaluation Level exceedances in the table below.

Stage 2 Monitoring Site ID	Analyte	Result from Two Quarters Ago	Result From Prior Quarter	Result From Current Quarter	Operational Evaluation Value
		A	B	C	D = (A+B +(2*C))/4
LC117 13 Village Drive	☒ TTHM ☐ HAA5	56.3	62.9	110.6	85.1
	☐ TTHM ☐ HAA5				
	☐ TTHM ☐ HAA5				
	☐ TTHM ☐ HAA5				
	☐ TTHM ☐ HAA5				
	☐ TTHM ☐ HAA5				
	☐ TTHM ☐ HAA5				
	☐ TTHM ☐ HAA5				
	☐ TTHM ☐ HAA5				
	☐ TTHM ☐ HAA5				
	☐ TTHM ☐ HAA5				
	☐ TTHM ☐ HAA5				

Note: The operational evaluation value is calculated by summing the two previous quarters of TTHM or HAAS values plus twice the current quarter value, divided by four. If the value exceeds 0.080 mg/L for TTHM or 0.060 mg/L for HAAS, an OEL exceedance has occurred.

IV. Operational Evaluation Findings

A. Did the **distribution system** cause or contribute to your OEL exceedance(s)? ☐ Yes ☐ No
If yes or possibly, explain below (attach additional pages if necessary). ☒ Possibly

See attachment 1 and Distrtibution System, Item I of this report

B. Did the **treatment system** cause or contribute to your OEL exceedance(s)? ☐ Yes ☒ No
If yes or possibly, explain below (attach additional pages if necessary). ☐ Possibly

C. Did source water quality cause or contribute to your OEL exceedance(s)? ☐ Yes ☐ No
If yes or possibly, explain below (attach additional pages if necessary). ☒ Possibly

Groton Utilities was only able to blend one of two low-TOC water sources with Poquonnock Reservoir, which may have limited TOC reduction at POE, also limiting how low THMs might be, leaving their WTP. See attachment 1 for more information.

D. Is all supporting operational or other data that support the determination of the cause(s) of your OEL exceedance(s) attached to this report? ☒ Yes ☐ No

E. If you are unable to determine the cause(s) of the OEL exceedance(s), list the steps that you can use to better identify the cause(s) in the future (attach additional pages if necessary):

F. List steps that could be considered to minimize future OEL exceedances (attach additional pages if necessary)

We began our routine flushing program in Ledyard Center in late March, flushing twice a week, and continue this twice-a-week flushing through the summer and fall. Our flushing program used to consist of once a week flushing from July to October, but due to warmer water temperatures persisting over a broader timespan of the year, we feel that this expanded flushing program is necessary for maintaining the best possible water quality in Ledyard Center. Additionally, we have taken steps to overflow Ledyard Center Tank at varying intervals to flush out water with high water age and bring fresher water into the tank, thereby reducing the water age in the tank (dechlorination of overflow water was performed at each instance of overflowing the tank).

G. Total Number of Pages Submitted, Including Attachments and Checklists: 18

TTHM and HAA5 Sample Collection and Handling Checklist

PWS ID: CT0727091 PWS Name: LWPCA - Ledyard Center

Compliance Period of OEL Exceedance(s): Q3 2023

Yes	No	
☒	☐	Did you obtain appropriate sample collection vials from the laboratory?
☒	☐	Did the sample vials contain the proper preservative and dechlorinating agents?
☒	☐	Was each vial labeled using waterproof labels and indelible ink?
		Did each vial contain the following information on the label?
☒	☐	Unique sample ID System name
☒	☐	Sample location
☒	☐	Sample date and time
☒	☐	An analysis required, if not already on label
☒	☐	Did you remove the aerator from the tap if there was one present?
☒	☐	Did you open the water tap and allow the system to flush until the water temperature had stabilized (usually about 3-5 minutes)?
☒	☐	Did you adjust the flow so that no air bubbles were visually detected in the flowing stream?
☒	☐	Did you slowly fill the sample vial almost to the top without overflowing?
☒	☐	Were you careful not to rinse out any of the preservative/dechlorinating agent during this process?
☒	☐	After the bottle was filled, did you invert it three or four times to mix the sample with the preservative and dechlorinating agents?
		If you collected a TTHM sample that requires acidification, did you :
☐	☐	Let the sample set for about 1 minute, allowing the dechlorinating chemical to take effect?
☐	☐	Carefully open the vial and adjust the pH of the TTHM sample to < 2 by adding approximately 4 drops of hydrochloric acid for every 40 m L of sample (amount of acid needed will depend on buffering capacity of sample)?
☐	☐	Recap the vial, and invert three or four times?
☒	☐	Did you invert the vial and tap it to check for air bubbles?
☒	☐	If bubbles were detected, did you carefully open the vial and add more sample water using the cap to achieve a headspace-free sample? (Note that air bubbles would more likely lead to a lower level of THMs or HAAs.)
☒	☐	Did you immediately cool the samples to 4°C by placing them in a cooler with frozen refrigerant packs or ice, or in a refrigerator? Samples should be maintained at this temperature during shipping to the laboratory.
☒	☐	Did you complete the Sample Chain of Custody provided by the laboratory and include it with the sample shipment?
☐	☒	Was the sample holding time of 14 days exceeded?
☐	☒	Was the extract holding time exceeded?
		EPA Method 551.1: 14 days at a temperature less than -10°C
		EPA Method 552.1: 48 hours at 4°C or less
		EPA Method 552.2: 7 days at 4 °C or 14 days at a temperature less than -10°C
		EPA Method 552.3: 21 days for MTBE extraction solvent at -10 °C or less
		OR 28 days for TAME extraction solvent at -10 °C or less
		Standard Method 6251 B: 21 days at -11 °C
☐	☒	Did the laboratory invalidate the sample?

Notes/Comments (attach additional sheets if necessary)

Our subcontract lab uses EPA method 524.3 for THM analyses. Preservatives are ascorbic acid and maleic acid, both in powder form. The 40 mL vials come with preservatives already added.

Distribution System Evaluation Checklist

PWS ID: CT0727091 PWS Name: LWPCA - Ledyard Center

Compliance Period of OEL Exceedance(s): Q3 2023

A. Do you have disinfectant residual or temperature data for the monitoring location where you experienced the OEL exceedance? ☒ Yes ☐ No

If yes, answer the following questions:

Yes	No	
☐	☒	Was the water temperature higher than normal for that time of the year at that location?
☐	☒	Was the disinfectant residual lower than normal for that time of the year at that location?
☐	☒	Was the disinfectant residual higher than normal for that time of the year at that location?

B. Do you have maintenance records available for the time period just prior to the OEL exceedance? ☒ Yes ☐ No

If yes, answer the following questions:

Yes	No	
☐	☒	Did any line breaks or replacements occur in the vicinity of the exceedance?
☐	☒	Were any storage tanks or reservoirs taken off-line and cleaned?
☐	☒	Did flushing or other hydraulic disturbances (e.g., fires) occur in the vicinity of the exceedance?
☐	☒	Were any valves operated in the vicinity of the OEL exceedances?

C. If your system is metered, do you have access to historical records showing water use at individual service connections? ☒ Yes ☐ No

If yes, was overall water use in your system unusually low, indicating higher than normal water age? ☒ Yes ☐ No

D. Do you have high-volume customers in your system (e.g., an industrial processing plant)? ☐ Yes ☒ No

If yes, was there a change in water use by a high-volume customer? ☐ Yes ☐ No

E. Is there a finished water storage facility hydraulically upstream from the monitoring location where you experienced the OEL exceedance? ☒ Yes ☐ No

If yes, review storage facility operations and water quality data to answer the following questions for the period in which the OEL exceedance occurred:

Yes	No	
☒	☐	Was a disinfectant residual detected in the stored water or at the tank outlet?
☒	☐	Do you know of any mixing problems with the tank or reservoir?
☒	☐	Does the facility operate in "last in-first out" mode?
☐	☒	Was the tank or reservoir drawn down more than usual prior to OEL exceedance, indicating a possible discharge of stagnant water?
☐	☒	Was there a change in water level fluctuations that would have resulted in increased water age within the tank or reservoir?

F. Does the system practice booster chlorination? ☐ Yes ☒ No

If yes, was there an increase in booster chlorination feed rates? ☐ Yes ☐ No

G. Did you have customer complaints in the vicinity of the OEL exceedance? ☐ Yes ☒ No

If yes, explain below:

Distribution System Evaluation Checklist

H. Did concern about complying with a rule other than Stage 2 DBPR, such as the Lead and Copper rule, the TCR, or any other rule constrain your options to reduce the DBP levels at this site? For example, are you limited by the need to maintain a detectable disinfectant residual in your ability to control DBP levels in the distribution system? ☐ Yes ☒ No

If yes, explain below and consult EPA's *Simultaneous Compliance Guidance Manual* for alternative compliance approaches:

I. Conclusion

Did the distribution system cause or contribute to the OEL exceedance(s)? ☐ Yes ☐ No
If yes or possibly, explain below (attach additional pages if necessary). ☒ Possibly

When water temperatures warm up, which seems to happen earlier in the year than it used to (and seems to stay warmer longer) the distribution system can contribute to an OEL exceedance due to residence time in the system, which is why, since 2021, we have expanded routine flushing to twice a week from late spring to mid-fall. We have also verified that water age in the Ledyard Center Tank can play a significant role in increasing the water age in the system at times. Please see attachment 1 for more information.

Treatment Process Evaluation Checklist

PWS ID: CT0727091 PWS Name: LWPCA - Ledyard Center

Compliance Period of OEL Exceedance(s): Q3 2023

A. Review finished water data for the time period prior to the OEL exceedance(s) and compare to historical finished water data using the following questions.

Were DBP precursors (TOC, DOC, SUVA, bromide, etc.) higher than normal?	☐ Yes	☒ No	☐ N/A
Was finished water pH higher or lower than normal?	☐ Yes	☒ No	
Was the finished water temperature higher than normal?	☐ Yes	☒ No	
Was finished water turbidity higher than normal?	☐ Yes	☒ No	☐ N/A
Was the disinfectant concentration leaving the plant(s) higher than normal?	☐ Yes	☒ No	
Were finished water TTHM/HAA5 levels higher than normal?	☐ Yes	☒ No	

Were operational and water quality data available to the system operator for effective decision making?
☒ Yes ☐ No

B. Does the treatment process include pre-disinfection? ☐ Yes ☒ No

If yes, answer the following questions for the period in which the OEL exceedance(s) occurred:

Yes	No	
☐	☐	Was disinfected raw water stored for an unusually long time?
☐	☐	Were treatment plant flows lower than normal?
☐	☐	Were treatment plant flows equally distributed among different trains?
☐	☐	Were water temperatures high or warmer than usual?
☐	☐	Were chlorine feed rates outside the normal range?
☐	☐	Was a disinfectant residual present in the treatment train following pre-disinfection?
☐	☐	Were online instruments utilized for process control?
☐	☐	Did you switch to free chlorine as the oxidant?
☐	☐	Was there a recent change (or addition) of pre-oxidant?

C. Does your treatment process include pre-sedimentation? ☐ Yes ☒ No

If yes, answer the following questions for the period in which the OEL exceedance(s) occurred:

Yes	No	
☐	☐	Were flows low?
☐	☐	Were flows high?
☐	☐	Were online instruments utilized for process control?
☐	☐	Was sludge removed from the pre-sedimentation basin?
☐	☐	Was sludge allowed to accumulate for an excessively long time?
☐	☐	Do you add a coagulant to your pre-sedimentation basin?
☐	☐	Was there a problem with the coagulant feed?

D. Does your treatment process include coagulation and/or flocculation? ☒ Yes ☐ No

If yes, answer the following questions for the period in which the OEL exceedance(s) occurred:

Yes	No	
☐	☒	Were there any feed pump failures or were feed pumps operating at improper feed rates?
☒	☐	Were chemical feed systems controlled by flow pacing?
☐	☒	Were there changes in coagulation practices or the feed point?
☐	☒	Did you change the type or manufacturer of the coagulant?
☐	☒	Do you suspect that the coagulant in use at the time of the OEL exceedance did not meet industry standards?
☐	☒	Did the pH or alkalinity change at the point of coagulant addition?
☐	☒	Were there broken or plugged mixers?
☐	☒	Were flow rates above the design rate or was there short-circuiting?

Treatment Process Evaluation Checklist

E. Does your treatment process include sedimentation or clarification? ☒ Yes ☐ No DAF process

If yes, answer the following questions for the period in which the OEL exceedance(s) occurred:

Yes	No	
☐	☒	Were there changes in plant flow rate that may have resulted in a decrease in settling time or carry-over of process solids?
☐	☒	Were settled water turbidities higher than normal?
☐	☒	Was there any disruption in the sludge blanket that may have resulted in carryover to the point of disinfection?
☐	☒	Was there any maintenance in the basin that may have stirred sludge from the bottom of the basin and caused it to carry over to the point of disinfectant addition?
☐	☒	Was sludge allowed to accumulate for an excessively long time or was there a malfunction in the sludge removal equipment?

F. Does your treatment process include sedimentation or clarification? ☒ Yes ☐ No

If yes, answer the following questions for the period in which the OEL exceedance(s) occurred:

Yes	No	
☐	☒	Was there an increase in individual or combined filter effluent turbidity or particle counts?
☐	☒	Was there an increase in turbidity or particle loading onto the filters?
☐	☒	Was there an increase in flow on to the filters or malfunction of the rate of flow controllers?
☐	☒	Were any filters taken offline for an extended period of time that caused the other filters to operate near maximum design capacity and created the conditions for possible breakthrough?
☐	☒	Were any filters operated beyond their normal filter run time?
☐	☒	Were there any unusual spikes in individual filter effluent turbidity (which may indicate particulate or colloidal TOC breakthrough) in the days leading to the excursion?
☒	☐	Were all filters run in a filter-t o-waste mode during initial filter ripening?
☐	☒	If GAC filters are used, is it possible the adsorptive capacity of the GAC bed was reached before reactivation occurred (leave blank if not applicable)?
☐	☐	If biological filtration is used, were there any process upsets that may have resulted in the breakthrough of TOC (leave blank if not applicable)?

G. Does your treatment process include primary disinfection by injecting chlorine prior to a clearwell? ☒ Yes ☐ No

If yes, answer the following questions for the period in which the OEL exceedance(s) occurred:

Yes	No	
☐	☒	Was there a sudden increase in the amount of chlorine fed or an increase in the chlorine residual?
☐	☒	Was there an increase in clearwell holding time?
☐	☒	Was the plant shutdown or were plant flows low?
☐	☒	Was there an increase in clearwell water temperature?
☐	☒	Did you switch to free chlorine recently as the primary disinfectant?
☐	☒	Was the inactivation of Giardia and/or viruses exceptionally high?
☐	☒	Was there a change in the mixing strategy (i.e., mixers not used, adjustment of tank level)?

H. Does your plant recycle spent filter backwash or other streams? ☐ Yes ☒ No

If yes, answer the following questions for the period in which the OEL exceedance(s) occurred:

Yes	No	
☐	☐	Did a change in the recycle stream quality contribute to increased DBP precursor loading that was not addressed by treatment plant processes?
☐	☐	Did a recycle event result in flows in excess of typical or design flows?

Treatment Process Evaluation Checklist

I. Do you inject a disinfectant after your clearwell to maintain a distribution system residual? ☐ Yes ☒ No

If yes, answer the following questions for the period in which the OEL exceedance(s) occurred:

Yes	No	
☐	☐	Was there a sudden increase in the amount of chlorine fed?
☐	☐	Was there a switch from chloramines to free chlorine for a burnout period?
☐	☐	If using chloramines, was the chlorine to ammonia ratio in the proper range?
☐	☐	Was there a problem with either chlorine or ammonia mixing?

J. Did concern about complying with a rule other than Stage 2 DBPR, such as the Lead and Copper Rule, the LT2ESWTR, or any other rule constrain your options to reduce the DBP levels? For example, are you limited by other treatment targets/requirements in your ability to control precursors in coagulation/flocculation? ☐ Yes ☒ No

If yes, explain below and consult EPA's *Simultaneous Compliance Guidance Manual* for alternative compliance approaches:

I. Conclusion

Did treatment factors and/or variations in the plant performance contribute to the OEL exceedance(s)? ☐

Yes ☒ No

If yes or possibly, explain below (attach additional pages if necessary). ☐ Possibly

Source Water Evaluation Checklist

PWS ID: CT0727091 PWS Name: LWPCA - Ledyard Center

Compliance Period of OEL Exceedance(s): Q3 2023

A. Do you have source water temperature data? ☒
Yes ☐ No

If yes, was the source water temperature high? ☐
Yes ☒ No

If yes, answer the following questions for the time period prior to the OEL exceedance(s):

Yes	No	
☐	☐	Was the raw water storage time longer than usual?
☐	☐	Did you place another water source on-line?
☐	☐	Were river/reservoir flow rates lower than usual? If yes, indicate the location of lower flow rates and the anticipated impact on the OEL exceedance.
☐	☐	Did point or non-point sources in the watershed contribute to the OEL exceedance?

B. Do you have data that characterizes organic matter in your source water (e.g., TOC, DOC, SUVA, color, THM formation potential)?
☒ Yes ☐ No

If yes, were these values higher than? ☐
Yes ☒ No

If yes, answer the following questions for the time period prior to the OEL exceedance(s):

Yes	No	
☐	☐	Did heavy rainfall or snowmelt occur in the watershed?
☐	☐	Did you place another water source on-line?
☐	☐	Did lake or reservoir turnover occur?
☐	☐	Did point or non-point sources in the watershed contribute to the OEL exceedance?
☐	☐	Did an algal bloom occur in the source water?
☐	☐	If algal blooms were present, were appropriate algae control measures employed (e.g., addition of copper sulfate)?
☐	☐	Did a taste and odor incident occur?

C. Do you have source water bromide data? ☐
Yes ☒ No

If yes, were the bromide levels higher or lower than normal? ☐
Yes ☐ No

If yes, answer the following questions for the time period prior to the OEL exceedance(s):

Yes	No	
☐	☐	Has salt water intrusion occurred?
☐	☐	Are you experiencing a long-term drought?
☐	☐	Did heavy rainfall or snowmelt occur in the watershed?
☐	☐	Did you place another water source on-line?
☐	☐	Are you aware of any industrial spills in the watershed?

D. Do you have source water turbidity or particle count data? ☒
Yes ☐ No

If yes, were the turbidity values or particle counts higher than normal? ☐
Yes ☒ No

If yes, answer the following questions for the time period prior to the OEL exceedance(s):

Yes	No	
☐	☐	Did lake or reservoir turnover occur?

Source Water Evaluation Checklist

☐	☐	Did heavy rainfall or snowmelt occur in the watershed?
☐	☐	Did logging, fires, or landslides occur in the watershed?
☐	☐	Were river/reservoir flow rates higher than normal?

E. Do you have source water pH or alkalinity data? ☒
Yes ☐ No

If yes, was the pH or alkalinity different from normal values? ☐
Yes ☒ No

If yes, answer the following questions for the time period prior to the OEL exceedance(s):

Yes	**No**	
☐	☐	Was there an algal bloom in the source water?
☐	☐	If algal blooms were present, were algae control measures employed?
☐	☐	Did heavy rainfall or snowmelt occur in the watershed?
☐	☐	Has the PWS experienced diurnal pH changes in source?

Source Water Evaluation Checklist

I. Conclusion

Did source water quality factors contribute to your OEL exceedance? ☐

Yes ☐ No

If yes or possibly, explain below (attach additional pages if necessary). ☒ Possibly

Groton Utilities was only able to blend one of two low-TOC water sources with Poquonnock Reservoir, which may have limited TOC reduction at POE, also limiting how low THMs might be, leaving their Water Treatment Plant. See attachment 1 for more information.

Ledyard Center OEL exceedance 3rd quarter 2023 Attachment #1

December 1, 2023

LWPCA-Ledyard Center, PWSID # CT0727091

LWPCA Ledyard Center water system (PWS ID # CT0727091) is a consecutive system to Groton Utilities, receiving its water supply via a water main traveling up Route 117 from Groton to Ledyard Center. Although there are some businesses in Ledyard Center, primarily on Route 117, none of them utilizes large quantities of water, and the remainder of Ledyard Center is residential. There is a centrally-located water standpipe (Ledyard Center Tank) which supplies additional water pressure, fire protection, and water storage to Ledyard Center.

With respect to THMs, Ledyard Center has the same kind of challenges that consecutive systems in general must overcome. Water age, warm water temperatures, and free chlorine are factors which affect THM formation in Ledyard Center. We have noticed a trend toward distribution water temperatures warming up earlier in the spring and staying warm later in the fall. We must have adequate free chlorine residual to maintain resistance to microbial growth in the distribution system (and we do). We cannot affect water temperatures and we are limited in our ability to reduce free chlorine; the factors over which we can exert some control are source water blending, prior to the Groton Utilities Water Treatment Plant, and, in Ledyard Center, the water age.

In the past, we maintained a once-a-week routine flushing program in Ledyard Center, which typically ran from July through the end of October. This was successful in moderating water age, and keeping the Ledyard Center system in compliance with the THM MCL, as well having an acceptable OEL calculation. Quarterly results (and therefore OEL calculations) began to rise and triggered OEL reports intermittently through the years, starting in the fourth quarter of 2016.

In July 2021 we experienced an unusually high THM result, which was unprecedented even for the third quarter (typically our highest-THM quarter)—139 ppb at 11 Village Drive and 131 ppb at the Village Market DBP2 sampling locations. When we received these results in August 2021, we immediately revised our flushing program to twice-a-week flushing through the end of October 2021.

Our Q4 2021 THM results were at the low end of typical Q4 ranges, demonstrating that the increased flushing was helping. Due to the very high Q3 2021 result, however, an OEL report was triggered for the 4th quarter just as it was for the 3rd quarter, but the RAA was still below 80 ppb at the Village Drive sample location.

Due to the resident at 11 Village Drive moving away and the new resident being unable to accommodate our request to continue sampling at that address, we submitted a new THM/HAA5 site for Ledyard Center, via the SSP form: 13 Village Drive, which is right next-door to 11 Village Drive. At that same time we requested to switch from Village Market to Ledyard Town Hall, as the more representative site in that vicinity of Ledyard Center. These site changes were approved by DPH, and we initiated sampling at those sites in April of 2022, and have continued using those locations since then.

In 2023, we continued the twice-a-week flushing protocol as in 2022. In addition, Groton Utilities once again blended several raw water sources with Poquonnock Reservoir, as they did in 2022 (the other sources are lower in TOC than Poquonnock Reservoir; the goal is to reduce TOC in POE water by reducing the TOC of the water entering treatment). They were only able to blend one water source (Smith Lake) with Poquonnock in July, which was helpful, but limited the reduction in TOC at the POE, compared to blending with several sources.

We have also recognized the role the Ledyard Center Tank plays in affecting the water age in Ledyard Center. In late summer of 2022, the Ledyard Center Tank was intentionally overflowed (all outflow was successfully dechlorinated), to good effect. The water age in the tank was greatly reduced, so when the tank was flowing back into the water system, its contribution to the water age in the system was not as significant.

We were unable to overflow the Tank in early-to-mid-summer of 2023 for operational reasons; later in the summer, we were able to do so at various intervals, and the effect was beneficial to the system but came too late to benefit the 3rd quarter results.

Our goal is to reduce water age in Ledyard Center enough to produce lower THM results for all quarters going forward, and in particular to see a return to typical or lower than typical results in the 4th quarter, if possible. Attachment #3 highlights the fact that water usage during the summer of 2023 was greatly reduced compared to the summer of 2022; the most likely reason being the consistently rainy summer of 2023. Reduced use increases water age, adding another challenge to Q3 2023. Attachment #2 compares the POE THMs to the quarterly Ledyard Center THMs (all samples collected the same day). Even though the POE THMs in July 2023 was nearly the same as in July 2021, the Ledyard Center THM values were much lower, although still higher than desirable. This was despite the usage in July 2023 being almost half that of July 2021 (see attachment #3); this shows that our efforts at blending raw water source at the Groton Water Treatment Plant and the twice-a-week flushing in Ledyard are producing positive results, and we are always working to produce even better results, if possible.

Another tool in reducing THMs in the water system is monitoring and optimizing treatment at Groton Utilities' Water Treatment Plant, to produce the lowest-TOC water possible. They have always tried to maintain the optimal PACL coagulant dose for this purpose, but one factor which has proved challenging is the incoming TOC in the raw water. The higher the raw TOC, the higher the POE TOC, since there is a limit to how much TOC they can remove even with optimal treatment. Please see attachment #4 for Groton WTP data through the recent years.

GU has blended Smith Lake water into Poquonnock Reservoir intake in past summers, since it is slightly lower in TOC than Poquonnock, but that has had a limited impact. In the past, they have been unable to take advantage of another source, Production Well #3, which is very low in TOC but relatively high in manganese, because it created a level of manganese in the raw water that the old Water Treatment Plant could not effectively remove. Their new DAF plant has a post-filtration treatment—manganese contactors—that effectively removes manganese from the finished water.

So now they are able to blend low-TOC Production Well #3 water with Poquonnock Reservoir water during the warm-water season. Unfortunately, they were unable to use production well #3 in July; it was run in conjunction with Smith Lake in August of this year, with good results.

As can be seen, our approach going forward is three-pronged: GU will continue to optimize treatment for maximum TOC removal, blend Production Well #3 and Smith Lake water with Poquonnock Reservoir water when possible and necessary to reduce finished water TOC, and continue to do routine twice-a-week flushing in Ledyard Center, in order to reduce LWPCA Ledyard Center THMs during the warm water season and return to compliance with the THM MCL. In addition, we will try to overflow Ledyard Center Tank as necessary during the warm-weather warm-water-temperature times of the year, while still being judicious in the use of this technique.

We anticipate that even with a good result for Q4 2023 THMs, Ledyard Center will likely experience a continued OEL exceedance in the fourth quarter (due once again to the high Q3 2023 result), but we believe that a good (typical or lower) result in Q1 2024 will drop the OEL calculation below the 80 ppb trigger.

Our detailed Action Plan for LWPCA-Ledyard Center is as follows (as noted in narrative):

- Expand the routine flushing season to include late March through the end of October
- Continue twice-a-week routine flushing as faithfully as possible during that timeframe
- Continue to optimize treatment at the GU WTP to remove as much TOC as possible

- Blend low-TOC water from Production Well #3 and/or Smith Lake with Poquonnock Reservoir at the GU WTP to reduce incoming raw TOC, as much as possible
- Overflow Ledyard Center Tank as necessary, but no more than necessary, while dechlorinating the outflow

Please also see the attached spreadsheets for further information regarding our water treatment and OEL data.

Attachment #2

Ledyard Center TTHM data

Date	POE TTHMs	Ledyard Center TTHMs 11 Village Dr	Ledyard Center TTHMs Village Market	Village Dr. - Village Mkt	Raw Temp (°C)	TOCs Raw	TOCs POE	TOCs %removal	Center Gro P. S. On / Off	Center Gro P. S. Flow (CFM)	LC Tank
01/11/18	13.6	49.3	43.5	5.8	2.3	5.04	2.01	60%	On	60.6	rising
04/11/18	14.7	49.6	47.9	1.7	7.0	3.37	1.42	58%	Off		falling
07/18/18	31.2	97.5	94.9	2.6	27.2	4.02	1.81	55%	On	67.5	rising
10/10/18	32.7	94.9	94.2	0.7	21.1	5.58	2.17	61%	Off		falling
01/09/19	11.6	47.8	41.4	6.4	3.9	-----	-----		On	31	rising
04/10/19	15.2	47.3	48.9	(1.6)	12.7	3.15	1.26	60%	Off		falling
07/08/19	27.7	95.1	93.8	1.3	26.3	3.82	1.49	61%	Off		falling
10/09/19	42.7	99.2	97.3	1.9	18.7	3.80	2.04	46%	Off		falling
01/15/20	14.2	55.4	59.0	(3.6)	12.4	3.74	1.24	67%		No data	
04/15/20	19.8	61.6	58.7	2.9	15.9	3.78	1.34	65%		No data	
07/15/20	37.0	77.7	95.3	(17.6)	27.0	4.21	1.61	62%	On	79	rising
10/14/20	28.2	73.7	76.5	(2.8)	15.5	3.57	1.69	53%	Off		falling
01/13/21	14.6	43.3	46.8	(3.5)	5.8	4.28	1.39	68%	Off		falling
04/21/21	21.1	54.9	58.4	(3.5)	13.4	3.95	1.44	64%		No data	
07/14/21	43.0	139.1	130.9	8.2	24.2	3.67	1.28	65%	Off		falling
10/13/21	32.4	77.6	77.0	0.6	21.2	4.00	1.90	53%	Off		falling
01/12/22	13.3	55.7	49.7	6.0	1.3	3.80	1.60	58%	Off		falling
		13 Village Dr.	Led. Town hall								
04/13/22	22.4	50.8	39.1	11.7	14.7	3.20	1.30	59%	On	53.3	rising
07/13/22	41.1	93.3	98.2	(4.9)	26.1	3.90	1.80	54%	Off		falling
10/12/22	16.8	57.4	51.7	5.7	15.1	2.70	1.40	48%	Off		falling
01/18/23	13.4	56.3	40.9	15.4	5.7	3.60	1.40	61%	Off		falling
04/20/23	21.3	62.9	52.6	10.3	14.5	3.40	1.30	62%	On	83.2	rising
07/19/23	39.2	110.6	100.1	10.5	27.3	3.80	1.60	58%	Off		falling

parentheses (x.x) indicate a negative number.

Attachment #3

Ledyard Center Water Usage, 2020 vs. 2021

	2020			2021				2022			2023			
	117 to Led. (cu. ft.)	117 to Gro (cu. ft.)	*net to Led. (gallons)*	117 to Led. (cu. ft.)	117 to Gro (cu. ft.)	*net to Led. (gallons)*		117 to Led. (cu. ft.)	117 to Gro (cu. ft.)	*net to Led. (gallons)*	117 to Led. (cu. ft.)	117 to Gro (cu. ft.)	*net to Led. (gallons)*	
January	547740	42360	*3780242*	776320	211100	*4227846*		992180	198930	*5933510*	1318564	718367	*4489474*	
February	567940	59460	*3803430*	814430	191380	*4660414*		685580	117270	*4250959*	1308941	706327	*4507553*	
March	544780	45720	*3732969*	793790	176610	*4616506*		825920	107480	*5373931*	1167581	643445	*3920537*	
April	599870	49650	*4115646*	794600	195810	*4478949*	Difference 2020 vs. 2021	962458	678656	*2122839*	1164713	696212	*3504387*	Difference 2022 vs. 2023
May	568160	51670	*3863345*	871040	181600	*5157011*	**1,293,666**	1489590	565029	*6915716*	1365973	785148	*4344571*	**-2,571,145**
June	1155030	118510	*7753170*	914260	154960	*5679564*	**-2,073,606**	1285534	544283	*5544557*	1405951	543529	*6450917*	**906,359**
July	756530	41440	*5348873*	852250	6100	*6329202*	**980,329**	1233107	505445	*5442912*	983432	549088	*3248893*	**-2,194,019**
August	832690	62240	*5762966*	879050	132400	*5584942*	**-178,024**	1372471	411893	*7185123*	1404451	716153	*5148469*	**-2,036,654**
September	678310	90860	*4394126*	791590	145700	*4831257*	**437,131**	1426484	560653	*6476416*	783433	401536	*2856590*	**-3,619,826**
October	704490	97450	*4540659*	821810	125870	*5205631*		792514	486503	*2288962*	1091873	532601	*4183355*	
November	627050	117190	*3813753*	840930	158220	*5106671*		1201481	774369	*3194798*			*0*	
December	710500	162830	*4096572*	955850	198470	*5665202*		1261832	681111	*4343793*			*0*	
Sum	8293090	939380	*55005751*			*61543196*				*59073517*			*42654745*	

Red = warm water data, May - September

Groton WTP data 2015 - 2023 **Attachment # 4**

Raw Water Temp (°C) monthly average

	2015	2016	2017	2018	2019	2020	2021	2022	2023
July	26	26	24	27	27	26	25	23	26
October	15	16	20	18	17	17	21	15.2	

Raw Water Turbidity monthly average

	2015	2016	2017	2018	2019	2020	2021	2022	2023
July	0.73	0.80	0.76	0.83	0.83	1.31	0.87	0.91	0.96
October	0.40	0.68	0.54	0.86	0.72	0.80	0.48	0.38	

Raw Water pH monthly average

	2015	2016	2017	2018	2019	2020	2021	2022	2023
July	7.1	6.9	6.5	6.7	6.7	6.8	6.6	6.5	6.4
October	7.0	6.9	7.0	6.6	7.0	6.9	6.6	6.6	

PACl dose (mg/L) monthly average

	2015	2016	2017	2018	2019	2020	2021	2022	2023
July	40	43.9	47.7	46.2	39.6	43.8	29	29	33
October	38.3	45.7	48.7	48.9	36	37.8	32.9	30	

Raw TOC (mg/L) monthly average

	2015	2016	2017	2018	2019	2020	2021	2022	2023
July	4.1	4.1	4.2	4.2	3.8	3.9	4.3	3.9	3.7
October	3.4	3.5	3.7	4.8	3.8	3.7	4.2	2.9	

POE TOC (mg/L) monthly average

	2015	2016	2017	2018	2019	2020	2021	2022	2023
July	1.6	1.7	1.8	1.8	1.6	1.6	1.6	1.9	1.7
October	1.7	1.6	1.7	1.7	1.9	1.6	1.9	1.3	

Chlorine data at Village Market when collecting TTHM samples

Village Market Chlorine (mg/L) (Ledyard Town Hall after April 2022)

Year	Jan	Apr	July	Oct
2016	0.85	1.26	0.50	0.43
2017	0.26	0.74	0.22	0.14
2018	0.83	0.93	0.16	0.13
2019	1.19	0.86	0.57	0.56
2020	0.82	1.03	0.24	0.55
2021	0.88	0.76	0.07	0.46
2022	0.98	1.36	0.51	0.90
2023	1.21	1.09	0.41	

11 Village Drive Chlorine (mg/L) (13 Village after April 2022)

Year	Jan	Apr	July	Oct
2016	0.27	0.45	0.54	0.42
2017	0.19	0.61	0.32	0.26
2018	0.50	0.91	0.20	0.04
2019	0.89	1.10	0.16	0.12
2020	0.28	0.85	0.51	0.22
2021	1.09	0.54	0.07	0.38
2022	0.72	0.80	0.61	0.64
2023	0.82	0.98	0.13	

Quarterly THMs *(ppb)*

POE Groton WTP	2015	2016	2017	2018	2019	2020	2021	2022	2023
July	32.8	34.2	38.8	31.2	27.7	37.0	43.0	41.1	39.2
October	22.9	19.7	24.0	32.7	42.7	28.2	32.4	16.8	

Quarterly THMs *(ppb)*

Village Market, Led. Ctr.	2015	2016	2017	2018	2019	2020	2021	2022	2023
July	89.3	108.9	105.0	94.9	93.8	95.3	130.9	98.2	100.1
October	57.2	89.3	77.1	94.2	97.3	76.5	77.0	51.7	

Quarterly THMs *(ppb)*

11 Village Dr., Led. Ctr.	2015	2016	2017	2018	2019	2020	2021	2022	2023
July	89.3	80.2	97.8	97.5	95.1	77.7	139.1	93.3	110.6
October	59.5	77.0	74.9	94.9	99.2	73.7	77.6	57.4	