TOWN OF WARE

Department of Public Works
4½ Church Street
Ware, Massachusetts 01082-0089

Tel. 413-967-9648 Ext702 Fax 413-967-9638
Email: gmcalmond@townofware.com

RFP ADDENDUM #2
Date of Addendum: June 23, 2023

Re: Responses to RFP Questions Submitted by the Connecticut Water Company

---

1. Have the wells been tested for per-and polyfluoroalkyl substances (PFAS)? If so, what are the results? Yes, the wells have been tested for PFAS results are attached as Exhibit #1

2. Please provide the most recent tank inspection reports. Tank Inspection Reports are attached as Exhibit #2

3. Is there currently GIS for the water and/or wastewater system mapping? Yes

4. To what degree are system records (tie cards, as-built drawings, operations data, water quality data) electronically available? Tie Cards are electronically available. What records are currently available as paper only? As-built drawings, operations data, and water quality data.

5. Please provide a description of the SCADA project that is planned for bid. Attached as Exhibit #3 is the project description.

6. Please provide the water system Unaccounted for Water trend for the past five years. 2022 – 9.48%, 2021 – 8.2%, 2020 – 20.3%, 2019 – 21.9%, 2018 – 13.0%.

7. What federal or state Administrative Orders, if any, have been issued to Town related to its water and/or wastewater operations? No Administrative Orders issued regarding the water or wastewater operations are outstanding. Are any Orders anticipated to be received that have not been formally issued to date? No.

8. What is the current staff count for both water and wastewater systems? Provide details of any relevant licenses and certifications. Do the employees have responsibilities beyond the water and sewer systems? Please provide an itemized list of all water and sewer system assets to be transferred, indicating vintage year and original cost. See Exhibit #4 attached.

9. Please provide revenue and expense details for the water and sewer systems for the last 5 years. Attached as Exhibit #5.

10. Provide the current detailed operating budget for the water and sewer systems. Attached as Exhibit #6.

11. Please provide questions from any other potential bidders and the associated responses. None

12. Please provide assumptions and supporting calculations used to derive the existing water and sewer rates. Attached as Exhibit #7.

End of Addendum #2.

EXHIBIT # 1

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

Western Regional Office • 436 Dwight Street, Springfield MA 01103 • 413-784-1100

Charles D. Baker
Governor

Karyn E. Polito
Lieutenant Governor

Bethany A. Card
Secretary

Martin Suuberg
Commissioner

August 31, 2022

SENT VIA ELECTRONIC MAIL: dpwwater@townofware.com

Ware Water Department
4 ½ Church Street
Ware, MA 01082
Attn: Andrew Lalashius

Re: Ware – DWP
Ware Water Department
PWS ID#: 1309000
PFAS Monitoring

Dear Mr. Lalashius:

The Massachusetts Department of Environmental Protection (MassDEP) Drinking Water Program has reviewed the Per- and Polyfluoroalkyl Substances (PFAS) results reported during the Initial Monitoring period for the Ware Water Department (Ware) public water system.

Ware completed four consecutive quarters of PFAS Initial Monitoring at Location 10010 (Point of Entry Post-Treatment Dismal Swamp Well 03G) and Location 10011 (Point of Entry Post-Treatment Sources 01G, 02G and 04G) during Quarter 4 of 2021 and Quarters 1, 2, and 3 of 2022. The PFAS6 results at Location 10010 ranged from 6.30 to 9.29 nanograms per liter (ng/L). The PFAS6 results at Location 10011 ranged from Non-Detect (below Minimum Reporting Level) to 7.96 ng/L. The PFAS6 Massachusetts Maximum Contaminant Level is 20 ng/L.

As a Community public water system serving more than 3,300 customers, Ware will be required to complete PFAS Routine Monitoring as follows:

Location 10010

PFAS monitoring annually during the first month of Quarter 1 (January to March).
The next required PFAS monitoring will be January 2023.

Location 10011

PFAS monitoring annually during the first month of Quarter 3 (July to September).
The next required PFAS monitoring will be July 2023.

These schedule changes are effective as of the date of this letter. These schedule changes will be reflected in subsequent Water Quality Sampling Schedules provided under separate correspondence.

Please note that no additional PFAS monitoring is required for the remainder of 2022.

If you have questions regarding this letter, please contact Christine Simard at christine.simard@mass.gov or me at 413-755-2148 or deirdre.doherty@mass.gov.

Sincerely,

Deirdre Doherty
Section Chief, Drinking Water Program
Western Regional Office

ecc: MassDEP WERO – J. Gibbs, C. Simard
MassDEP Boston – M. Finn

SP \DEP WERO\BWR\WS\PFAS\1309000-2022-08-31-LTR-PFAS-SS Mod-Ware

PHOENIX
Environmental Laboratories, Inc.

Thursday, February 09, 2023

Attn: John Bonafini Jr.
Quabbin Analytical Lab
9 Stadler Street
Belchertown, MA 01007

Project ID: WARE WATER DEPT
SDG ID: GCN28873
Sample ID#s: CN28873 - CN28874

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B
NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel: (860) 645-1102 Fax (860) 645-0823

Sample Id Cross Reference

February 09, 2023

SDG I.D.: GCN28873

Project ID: WARE WATER DEPT

Client Id	Lab Id	Matrix
PE 100-1	CN28873	DRINKING WATER
PE 100-2 FB	CN28874	DRINKING WATER

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

February 09, 2023

FOR: Attn: John Bonafini Jr.
Quabbin Analytical Lab
9 Stadler Street
Belchertown, MA 01007

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		01/24/23	9:29
Location Code:	QUABBINFORDEP	Received by:	CP	01/24/23	14:05
Rush Request:	72 Std	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN28873
Phoenix ID: CN28873

Project ID: WARE WATER DEPT
Client ID: PE 100-1

Parameter	Result		RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference	
PFAS (18)	Completed								02/02/23	***	537.1	c
PFAS (18)												
11Cl-PF3OUdS	ND		2.00	1	ng/L				02/03/23	***	537.1	c
9Cl-PF3ONS	ND		2.00	1	ng/L				02/03/23	***	537.1	c
ADONA	ND		2.00	1	ng/L				02/03/23	***	537.1	c
HFPO-DA	ND		2.00	1	ng/L				02/03/23	***	537.1	c
NEtFOSAA	ND		2.00	1	ng/L				02/03/23	***	537.1	c
NMeFOSAA	ND		2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorobutanesulfonic Acid (PFBS)	ND		2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorodecanoic Acid (PFDA)	ND		2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorododecanoic Acid (PFDoA)	ND		2.00	1	ng/L				02/03/23	***	537.1	c
Perfluoroheptanoic Acid (PFHpA)	ND		2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorohexanesulfonic Acid (PFHxS)	1.96	J	2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorohexanoic Acid (PFHxA)	ND		2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorononanoic Acid (PFNA)	ND		2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorooctanesulfonic Acid (PFOS)	3.32		2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorooctanoic Acid (PFOA)	0.964	J	2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorotetradecanoic Acid (PFTA)	ND		2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorotridecanoic Acid (PFTrDA)	ND		2.00	1	ng/L				02/03/23	***	537.1	c
Perfluoroundecanoic Acid (PFUnA)	ND		2.00	1	ng/L				02/03/23	***	537.1	c
QA/QC Surrogates												
% 13C3-HFPO-DA	85.0			1	%	NA	NA	NA	02/03/23	***	70 - 130 %	c
% 13C-PFDA	106			1	%	NA	NA	NA	02/03/23	***	70 - 130 %	c
% 13C-PFHxA	96.0			1	%	NA	NA	NA	02/03/23	***	70 - 130 %	c
% d5-NEtFOSA	93.0			1	%	NA	NA	NA	02/03/23	***	70 - 130 %	c

Project ID: WARE WATER DEPT
Client ID: PE 100-1

Phoenix I.D.: CN28873

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances J=Estimated Below RL LOD=Limit of Detection MDL=Method Detection Limit1
QA/QC Surrogates: Surrogates are compounds (preceeded with a %) added by the lab to determine analysis efficiency. Surrogate results(%) listed in the report are not "detected" compounds.

Comments:

*See attached

PFAS (18) (537.1), PFAS Extraction (537.1) were analyzed by MA certified lab #M-MA030.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director
February 09, 2023
Reviewed and Released by: Helen Geoghegan, Project Manager

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel (860) 645-1102 Fax (860) 645-0823

Analysis Report

February 09, 2023

FOR: Attn: John Bonafini Jr.
Quabbin Analytical Lab
9 Stadler Street
Belchertown, MA 01007

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		01/24/23	9:29
Location Code:	QUABBINFORDEP	Received by:	CP	01/24/23	14:05
Rush Request:	72 Std	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCN28873
Phoenix ID: CN28874

Project ID: WARE WATER DEPT
Client ID: PE 100-2 FB

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference	
PFAS (18)	Completed							02/02/23	***	537.1	c
PFAS (18)											
11Cl-PF3OUdS	ND	2.00	1	ng/L				02/03/23	***	537.1	c
9Cl-PF3ONS	ND	2.00	1	ng/L				02/03/23	***	537.1	c
ADONA	ND	2.00	1	ng/L				02/03/23	***	537.1	c
HFPO-DA	ND	2.00	1	ng/L				02/03/23	***	537.1	c
NEtFOSAA	ND	2.00	1	ng/L				02/03/23	***	537.1	c
NMeFOSAA	ND	2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorobutanesulfonic Acid (PFBS)	ND	2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorodecanoic Acid (PFDA)	ND	2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorododecanoic Acid (PFDoA)	ND	2.00	1	ng/L				02/03/23	***	537.1	c
Perfluoroheptanoic Acid (PFHpA)	ND	2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorohexanesulfonic Acid (PFHxS)	ND	2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorohexanoic Acid (PFHxA)	ND	2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorononanoic Acid (PFNA)	ND	2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorooctanesulfonic Acid (PFOS)	ND	2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorooctanoic Acid (PFOA)	ND	2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorotetradecanoic Acid (PFTA)	ND	2.00	1	ng/L				02/03/23	***	537.1	c
Perfluorotridecanoic Acid (PFTrDA)	ND	2.00	1	ng/L				02/03/23	***	537.1	c
Perfluoroundecanoic Acid (PFUnA)	ND	2.00	1	ng/L				02/03/23	***	537.1	c
QA/QC Surrogates											
% 13C3-HFPO-DA	93.0		1	%	NA	NA	NA	02/03/23	***	70 - 130 %	c
% 13C-PFDA	109		1	%	NA	NA	NA	02/03/23	***	70 - 130 %	c
% 13C-PFHxA	99.0		1	%	NA	NA	NA	02/03/23	***	70 - 130 %	c
% d5-NEtFOSA	96.0		1	%	NA	NA	NA	02/03/23	***	70 - 130 %	c

Ver 1

Project ID: WARE WATER DEPT
Client ID: PE 100-2 FB

Phoenix I.D.: CN28874

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances LOD=Limit of Detection
MDL=Method Detection Limit1
QA/QC Surrogates: Surrogates are compounds (preceeded with a %) added by the lab to determine analysis efficiency. Surrogate results(%) listed in the report are not "detected" compounds.

Comments:

*See attached

PFAS (18) (537.1), PFAS Extraction (537.1) were analyzed by MA certified lab #M-MA030.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director
February 09, 2023
Reviewed and Released by: Helen Geoghegan, Project Manager

Thursday, February 09, 2023

Criteria: MA_DW

State: MA

Sample Criteria Exceedances Report

GCN28873 - QUABBINFORDEP

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units

*** No Data to Display ***

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

PHOENIX
Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

ACCREDITED IN ACCORDANCE WITH nelac
NY # 11301

Analysis Comments

February 09, 2023

SDG I.D.: GCN28873

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

PWSID #1309000 Loc. code 10010 (COM) (RS)

Cooler: IPK Yes ICE Yes No No
Coolant: Temp 1.8 °C Pg of

PHOENIX
Environmental Laboratories, Inc.

CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email Makrina Nolan: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Data Delivery/Contact Options:
- Fax:
- Phone:
- Email:

Customer: Quabbin Analytical Lab
Address: 9 Stadler Street, Belchertown, MA 01007

Project: Ware Water Dept.
Report to:
Invoice to:
QUOTE # FOR DEP

Project P.O:

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature _____ Date: _____

Matrix Code:
DW=Drinking Water GW=Ground Water SW=Surface Water WW=Waste Water
RW=Raw Water SE=Sediment SL=Sludge S=Soil SD=Solid W=Wipe OIL=Oil
B=Bulk L=Liquid X = _____(Other)

Analysis Request: PFAS 537.1 (Full Method)

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	MS/MSD*	Gl. Amber 8 oz. [ ] H2SO4 [ ] Methanol [ ] NaHSO4 [ ] H2O	Soil VOA Vials [ ]	Gl. Soil container [ ]	Gl. Soil container [ ] 4oz	40 ml VOA Vial [ ]	Gl. Amber 1000ml [ ] As is [ ] HCL	Pl. As is [ ]	Pl. H2SO4 [ ]	Pl. HNO3 250ml	Pl. NaOH 250ml	Bacteria Bottle w/Na	Bacteria Bottle as is
28873	PE 100-1	DW	11/24/23	9:29AM	X							2					
28874	PE 100-2	FB	11/24/23	9:31AM	X							2					

Relinquished by:	Accepted by:	Date:	Time:
		11/27/23	11:58
		11/27/23	14:08

Comments, Special Requirements or Regulations:

*MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.

Turnaround Time:
- 1 Day*
- 2 Days*
- 3 Days*
- Standard
- Other

* SURCHARGE APPLIES

RI
- (Residential) Direct Exposure
- (Comm/Industrial) Direct Exposure
- GA Leachability
- GB Leachability
- GA-GW Objectives
- GB-GW Objectives

CT
- RCP Cert
- GW Protection
- SW Protection
- GA Mobility
- GB Mobility
- Residential DEC
- I/C DEC
- Other

MA
- MCP Certification
- GW-1
- GW-2
- GW-3
- MWRA eSMART
- S-1 10% CALC
- S-1 GW-1 S-1 GW-2 S-1 GW-3
- S-2 GW-1 S-2 GW-2 S-2 GW-3
- S-3 GW-1 S-3 GW-2 S-3 GW-3
- SW Protection

State where samples were collected: _____

Data Format
- Excel
- PDF
- GIS/Key
- EQuIS
- Other

Data Package
- Tier II Checklist
- Full Data Package*
- Phoenix Std Report
- Other

* SURCHARGE APPLIES

PEL 128 REV. 03/22

Page 9 of 23

ANALYTICAL REPORT

Lab Number:	L2304153
Client:	Phoenix Environmental Labs 587 East Middle Turnpike P.O. Box 370 Manchester, CT 06040
ATTN:	Helen Geoghegan
Phone:	(860) 645-8726
Project Name:	GCN28873
Project Number:	GCN28873
Report Date:	02/08/23

Certifications & Approvals: MA (M-MA030), NH NELAP (2062), CT (PH-0141), DoD (L2474), FL (E87814), IL (200081), LA (85084), ME (MA00030), MD (350), NJ (MA015), NY (11627), NC (685), OH (CL106), PA (68-02089), RI (LA000299), TX (T104704419), VT (VT-0015), VA (460194), WA (C954), US Army Corps of Engineers, USDA (Permit #P330-17-00150), USFWS (Permit #206964).

320 Forbes Boulevard, Mansfield, MA 02048-1806
508-822-9300 (Fax) 508-822-3288 800-624-9220 - www.alphalab.com

Project Name: GCN28873
Project Number: GCN28873

Lab Number: L2304153
Report Date: 02/08/23

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2304153-01	CN28873	DW	MA	01/24/23 09:29	01/25/23
L2304153-02	CN28874 FB	DW	MA	01/24/23 09:29	01/25/23

Project Name:	GCN28873	**Lab Number:**	L2304153
Project Number:	GCN28873	**Report Date:**	02/08/23

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc). Sample specific Quality Control data (I e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively

When multiple Batch Quality Control elements are reported (e g. more than one LCS) the associated samples for each element are noted in the grey shaded header line of each data table Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report located directly after the Case Narrative QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name:	GCN28873	**Lab Number:**	L2304153
Project Number:	GCN28873	**Report Date:**	02/08/23

Case Narrative (continued)

Report Submission

All non-detect (ND) or estimated concentrations (J-qualified) have been quantitated to the limit noted in the MDL column.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Ashley Boucher Ashley Boucher

Title: Technical Director/Representative

Date: 02/08/23

ORGANICS

SEMIVOLATILES

Serial_No:02082311:00

Project Name:	GCN28873	**Lab Number:**	L2304153
Project Number:	GCN28873	**Report Date:**	02/08/23

SAMPLE RESULTS

Lab ID:	L2304153-01	Date Collected:	01/24/23 09:29
Client ID:	CN28873	Date Received:	01/25/23
Sample Location:	MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Dw	Extraction Method:	EPA 537.1
Analytical Method:	133,537.1	Extraction Date:	02/02/23 14:32
Analytical Date:	02/03/23 18:19		
Analyst:	SL		

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab						
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	2.00	0.596	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	2.00	0.596	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND		ng/l	2.00	0.596	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	2.00	0.596	1
Perfluorohexanesulfonic Acid (PFHxS)	1.96	J	ng/l	2.00	0.596	1
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	0.596	1
Perfluorooctanoic Acid (PFOA)	0.964	J	ng/l	2.00	0.596	1
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	0.596	1
Perfluorooctanesulfonic Acid (PFOS)	3.32		ng/l	2.00	0.596	1
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	0.596	1
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	0.596	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	2.00	0.596	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	0.596	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	0.596	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	0.596	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	0.596	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	2.00	0.596	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	2.00	0.596	1
PFAS, Total (6)	3.32		ng/l	2.00	0.596	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	96		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	85		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	106		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	93		70-130

Serial_No:02082311:00

Project Name: GCN28873
Project Number: GCN28873

Lab Number: L2304153
Report Date: 02/08/23

SAMPLE RESULTS

Lab ID: L2304153-02
Client ID: CN28874 FB
Sample Location: MA

Date Collected: 01/24/23 09:29
Date Received: 01/25/23
Field Prep: Not Specified

Sample Depth:
Matrix: Dw
Analytical Method: 133,537.1
Analytical Date: 02/03/23 18:28
Analyst: SL

Extraction Method: EPA 537.1
Extraction Date: 02/02/23 14:32

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab						
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	2.00	0.597	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	2.00	0.597	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND		ng/l	2.00	0.597	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	2.00	0.597	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	2.00	0.597	1
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	0.597	1
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	0.597	1
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	0.597	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	0.597	1
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	0.597	1
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	0.597	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	2.00	0.597	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	0.597	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	0.597	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	0.597	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	0.597	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	2.00	0.597	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	2.00	0.597	1
PFAS Total (6)	ND		ng/l	2.00	0.597	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	99		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	93		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	109		70-130
N-Deuteroethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	96		70-130

Serial_No:02082311:00

Project Name: GCN28873
Project Number: GCN28873

Lab Number: L2304153
Report Date: 02/08/23

Method Blank Analysis
Batch Quality Control

Analytical Method: 133,537.1
Analytical Date: 02/03/23 17:00
Analyst: SL

Extraction Method: EPA 537.1
Extraction Date: 02/02/23 14:32

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab for sample(s): 01-02 Batch: WG1739724-1					
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	2.00	0.668
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	2.00	0.668
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND		ng/l	2.00	0.668
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	2.00	0.668
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	2.00	0.668
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	0.668
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	0.668
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	0.668
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	0.668
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	0.668
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	0.668
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	2.00	0.668
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	0.668
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	0.668
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	0.668
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	0.668
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	2.00	0.668
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	2.00	0.668
PFAS Total (6)	ND		ng/l	2.00	0.668

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	83		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	75		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	86		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	90		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: GCN28873
Project Number: GCN28873

Lab Number: L2304153
Report Date: 02/08/23

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 Batch: WG1739724-2								
Perfluorobutanesulfonic Acid (PFBS)	97		-		50-150	-		30
Perfluorohexanoic Acid (PFHxA)	94		-		50-150	-		30
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	82		-		50-150	-		30
Perfluoroheptanoic Acid (PFHpA)	90		-		50-150	-		30
Perfluorohexanesulfonic Acid (PFHxS)	92		-		50-150	-		30
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	91		-		50-150	-		30
Perfluorooctanoic Acid (PFOA)	100		-		50-150	-		30
Perfluorononanoic Acid (PFNA)	106		-		50-150	-		30
Perfluorooctanesulfonic Acid (PFOS)	97		-		50-150	-		30
Perfluorodecanoic Acid (PFDA)	92				50-150	-		30
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	92		-		50-150	-		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	84		-		50-150	-		30
Perfluoroundecanoic Acid (PFUnA)	96		-		50-150	-		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	96		-		50-150	-		30
Perfluorododecanoic Acid (PFDoA)	104		-		50-150	-		30
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	76		-		50-150	-		30
Perfluorotridecanoic Acid (PFTrDA)	108		-		50-150	-		30
Perfluorotetradecanoic Acid (PFTA)	128		-		50-150	-		30

Lab Control Sample Analysis
Batch Quality Control

Project Name: GCN28873
Project Number: GCN28873

Lab Number: L2304153
Report Date: 02/08/23

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 Batch: WG1739724-2								

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	91				70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	81				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	92				70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	98				70-130

Matrix Spike Analysis
Batch Quality Control

Project Name: GCN28873
Project Number: GCN28873
Lab Number: L2304153
Report Date: 02/08/23

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 QC Batch ID: WG1739724-3 QC Sample: L2303944-01 Client ID: MS Sample												
Perfluorobutanesulfonic Acid (PFBS)	3.86	1.58	5.35	94		-	-		50-150	-		30
Perfluorohexanoic Acid (PFHxA)	3.46	1.78	5.06	90		-	-		50-150	-		30
2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-Heptafluoropropoxy)-Propanoic Acid (HFPO-DA)	ND	1.78	1.36J	76		-	-		50-150	-		30
Perfluoroheptanoic Acid (PFHpA)	1.66JZ	1.78	3.24	182	Q	-	-		50-150	-		30
Perfluorohexanesulfonic Acid (PFHxS)	1.98J	1.63	3.46	91		-	-		50-150	-		30
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND	1.68	1.60J	95		-	-		50-150	-		30
Perfluorooctanoic Acid (PFOA)	6.56	1.78	8.63	116		-	-		50-150	-		30
Perfluorononanoic Acid (PFNA)	0.628JZ	1.78	2.78	156	Q	-	-		50-150	-		30
Perfluorooctanesulfonic Acid (PFOS)	8.18	1.65	9.81	98		-	-		50-150	-		30
Perfluorodecanoic Acid (PFDA)	ND	1.78	2.07	116		-	-		50-150	-		30
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND	1.66	1.71J	103		-	-		50-150	-		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND	1.78	1.60J	90		-	-		50-150	-		30
Perfluoroundecanoic Acid (PFUnA)	ND	1.78	1.96J	110		-	-		50-150	-		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND	1.78	1.64J	92		-	-		50-150	-		30
Perfluorododecanoic Acid (PFDoA)	ND	1.78	2.00	112		-	-		50-150	-		30
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND	1.68	1.14J	68		-	-		50-150	-		30
Perfluorotridecanoic Acid (PFTrDA)	ND	1.78	2.07	116		-	-		50-150	-		30
Perfluorotetradecanoic Acid (PFTA)	ND	1.78	2.28	128		-	-		50-150	-		30

Matrix Spike Analysis
Batch Quality Control

Project Name: GCN28873
Project Number: GCN28873

Lab Number: L2304153
Report Date: 02/08/23

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits

Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 QC Batch ID: WG1739724-3 QC Sample: L2303944-01 Client ID: MS Sample

Surrogate	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-13C3-Propanoic Acid (M3HFPO-DA)	84				70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	93				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	103				70-130
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	95				70-130

Project Name: GCN28873
Project Number: GCN28873

Lab Duplicate Analysis
Batch Quality Control

Lab Number: L2304153
Report Date: 02/08/23

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 QC Batch ID: WG1739724-4 QC Sample: L2304122-01 Client ID: DUP Sample						
Perfluorobutanesulfonic Acid (PFBS)	0.824J	0.796J	ng/l	NC		30
Perfluorohexanoic Acid (PFHxA)	1.22J	1.23J	ng/l	NC		30
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid (HFPO-DA)	ND	ND	ng/l	NC		30
Perfluoroheptanoic Acid (PFHpA)	ND	ND	ng/l	NC		30
Perfluorohexanesulfonic Acid (PFHxS)	ND	ND	ng/l	NC		30
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND	ND	ng/l	NC		30
Perfluorooctanoic Acid (PFOA)	1.29J	1.30J	ng/l	NC		30
Perfluorononanoic Acid (PFNA)	ND	ND	ng/l	NC		30
Perfluorooctanesulfonic Acid (PFOS)	ND	ND	ng/l	NC		30
Perfluorodecanoic Acid (PFDA)	ND	ND	ng/l	NC		30
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND	ND	ng/l	NC		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND	ND	ng/l	NC		30
Perfluoroundecanoic Acid (PFUnA)	ND	ND	ng/l	NC		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND	ND	ng/l	NC		30
Perfluorododecanoic Acid (PFDoA)	ND	ND	ng/l	NC		30
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND	ND	ng/l	NC		30
Perfluorotridecanoic Acid (PFTrDA)	ND	ND	ng/l	NC		30
Perfluorotetradecanoic Acid (PFTA)	ND	ND	ng/l	NC		30

Lab Duplicate Analysis
Batch Quality Control

Project Name: GCN28873
Project Number: GCN28873
Lab Number: L2304153
Report Date: 02/08/23

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits

Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 QC Batch ID: WG1739724-4 QC Sample: L2304122-01 Client ID: DUP Sample

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	92		96		70-130
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-13C3-Propanoic Acid (M3HFPO-DA)	84		84		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	97		97		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	97		91		70-130

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2304153-01A	Plastic 250ml Trizma preserved	A	NA		4.2	Y	Absent		A2-MA-537 1(14)
L2304153-01B	Plastic 250ml Trizma preserved	A	NA		4.2	Y	Absent		A2-MA-537 1(14)
L2304153-02A	Plastic 250ml Trizma preserved	A	NA		4.2	Y	Absent		A2-MA-537 1(14)

*Values in parentheses indicate holding time in days

Project Name: GCN28873 **Lab Number:** L2304153

Project Number: GCN28873 **Report Date:** 02/08/23

PFAS PARAMETER SUMMARY

Parameter	Acronym	CAS Number
PERFLUOROALKYL CARBOXYLIC ACIDS (PFCAs)		
Perfluorooctadecanoic Acid	PFODA	16517-11-6
Perfluorohexadecanoic Acid	PFHxDA	67905-19-5
Perfluorotetradecanoic Acid	PFTA/PFTeDA	376-06-7
Perfluorotridecanoic Acid	PFTrDA	72629-94-8
Perfluorododecanoic Acid	PFDoA	307-55-1
Perfluoroundecanoic Acid	PFUnA	2058-94-8
Perfluorodecanoic Acid	PFDA	335-76-2
Perfluorononanoic Acid	PFNA	375-95-1
Perfluorooctanoic Acid	PFOA	335-67-1
Perfluoroheptanoic Acid	PFHpA	375-85-9
Perfluorohexanoic Acid	PFHxA	307-24-4
Perfluoropentanoic Acid	PFPeA	2706-90-3
Perfluorobutanoic Acid	PFBA	375-22-4
PERFLUOROALKYL SULFONIC ACIDS (PFSAs)		
Perfluorododecanesulfonic Acid	PFDoDS/PFDoS	79780-39-5
Perfluorodecanesulfonic Acid	PFDS	335-77-3
Perfluorononanesulfonic Acid	PFNS	68259-12-1
Perfluorooctanesulfonic Acid	PFOS	1763-23-1
Perfluoroheptanesulfonic Acid	PFHpS	375-92-8
Perfluorohexanesulfonic Acid	PFHxS	355-46-4
Perfluoropentanesulfonic Acid	PFPeS	2706-91-4
Perfluorobutanesulfonic Acid	PFBS	375-73-5
Perfluoropropanesulfonic Acid	PFPrS	423-41-6
FLUOROTELOMERS		
1H,1H,2H,2H-Perfluorododecanesulfonic Acid	10:2FTS	120226-60-0
1H,1H,2H,2H-Perfluorodecanesulfonic Acid	8:2FTS	39108-34-4
1H,1H,2H,2H-Perfluorooctanesulfonic Acid	6:2FTS	27619-97-2
1H,1H,2H,2H-Perfluorohexanesulfonic Acid	4:2FTS	757124-72-4
PERFLUOROALKANE SULFONAMIDES (FASAs)		
Perfluorooctanesulfonamide	FOSA/PFOSA	754-91-6
N-Ethyl Perfluorooctane Sulfonamide	NEtFOSA	4151-50-2
N-Methyl Perfluorooctane Sulfonamide	NMeFOSA	31506-32-8
PERFLUOROALKANE SULFONYL SUBSTANCES		
N-Ethyl Perfluorooctanesulfonamido Ethanol	NEtFOSE	1691-99-2
N-Methyl Perfluorooctanesulfonamido Ethanol	NMeFOSE	24448-09-7
N-Ethyl Perfluorooctanesulfonamidoacetic Acid	NEtFOSAA	2991-50-6
N-Methyl Perfluorooctanesulfonamidoacetic Acid	NMeFOSAA	2355-31-9
PER- and POLYFLUOROALKYL ETHER CARBOXYLIC ACIDS		
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid	HFPO-DA	13252-13-6
4,8-Dioxa-3h-Perfluorononanoic Acid	ADONA	919005-14-4
CHLORO-PERFLUOROALKYL SULFONIC ACIDS		
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1
PERFLUOROETHER SULFONIC ACIDS (PFESAs)		
Perfluoro(2-Ethoxyethane)Sulfonic Acid	PFEESA	113507-82-7
PERFLUOROETHER/POLYETHER CARBOXYLIC ACIDS (PFPCAs)		
Perfluoro-3-Methoxypropanoic Acid	PFMPA	377-73-1
Perfluoro-4-Methoxybutanoic Acid	PFMBA	863090-89-5
Nonafluoro-3,6-Dioxaheptanoic Acid	NFDHA	151772-58-6

Project Name: GCN28873 **Lab Number:** L2304153

Project Number: GCN28873 **Report Date:** 02/08/23

PFAS PARAMETER SUMMARY

Parameter	Acronym	CAS Number
FLUOROTELOMER CARBOXYLIC ACIDS (FTCAs)		
3-Perfluoroheptyl Propanoic Acid	7 3FTCA	812-70-4
2H,2H 3H,3H-Perfluorooctanoic Acid	5 3FTCA	914637-49-3
3-Perfluoropropyl Propanoic Acid	3 3FTCA	356-02-5

Project Name:	GCN28873	**Lab Number:**	L2304153
Project Number:	GCN28873	**Report Date:**	02/08/23

GLOSSARY

Acronyms

DL	- Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EMPC	- Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LOD	- Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
LOQ	- Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.) Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
NR	- No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TEF	- Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.
TEQ	- Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Report Format: DU Report with 'J' Qualifiers

Project Name:	GCN28873	**Lab Number:**	L2304153
Project Number:	GCN28873	**Report Date:**	02/08/23

Footnotes

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Chlordane: The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Gasoline Range Organics (GRO): Gasoline Range Organics (GRO) results include all chromatographic peaks eluting from Methyl tert butyl ether through Naphthalene, with the exception of GRO analysis in support of State of Ohio programs, which includes all chromatographic peaks eluting from Hexane through Dodecane.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW compliance analysis only, the 'PFAS, Total (6)' result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution. The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e. co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. The Target analyte concentration is below the quantitation limit (RL), but above the Method Detection Limit (MDL) or Estimated Detection Limit (EDL) for SPME related analyses. This represents an estimated concentration for Tentatively

Report Format: DU Report with 'J' Qualifiers

Project Name:	GCN28873	**Lab Number:**	L2304153
Project Number:	GCN28873	**Report Date:**	02/08/23

Data Qualifiers

Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

ND - Not detected at the method detection limit (MDL) for the sample, or estimated detection limit (EDL) for SPME-related analyses.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

V - The surrogate associated with this target analyte has a recovery outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only)

Z - The batch matrix spike and/or duplicate associated with this target analyte has a recovery/RPD outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Report Format *DU Report with 'J' Qualifiers*

Project Name:	GCN28873	**Lab Number:**	L2304153
Project Number:	GCN28873	**Report Date:**	02/08/23

REFERENCES

133 Determination of Selected Per- and Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). EPA Method 537.1, EPA/600/R-18/352. Version 1.0, November 2018.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624/624.1: m/p-xylene, o-xylene, Naphthalene
EPA 625/625.1: alpha-Terpineol
EPA 8260C/8260D: NPW: 1,2,4,5-Tetramethylbenzene, 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene, 4-Ethyltoluene,
EPA 8270D/8270E: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine, alpha-Terpineol; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3,

Mansfield Facility
SM 2540D: TSS
EPA 8082A: NPW: PCB 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187,
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylth ophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0 Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2:** Nitrate-N, Nitrite-N; **SM4500NO3-F** Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 332: Perchlorate **EPA 524.2:** THMs and VOCs, **EPA 504.1:** EDB, DBCP
Microbiology SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1** Ammonia-N, **LACHAT 10-107-06-1-B:** Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2** Nitrate-N, **SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1 Volatile Halocarbons & Aromatics,
EPA 608.3 Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1 SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045** PCB-Oil
Microbiology: SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603, SM9222D.

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn, **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522, EPA 537.1.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb, As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

L2304153 1/30/23

Serial_No:02082314:00 Cooler: Yes ☐ No ☐ Coolant: tPK ☐ ICE ☐ No ☐

Temp °C Pg of

CHAIN OF CUSTODY RECORD

Page 1 of 1

PHOENIX Environmental Laboratories, Inc.

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040

Email: info@phoenixlabs.com Fax (860) 645-0823

Client Services (860) 645-8726

Contact Options:
- ☐ Fax: 860-645-0823
- ☐ Phone: 800-827-5428
- ☐ Email: HelenG@PhoenixLabs.com

Customer: Alpha Analytical
Address: 8 Walkup Dr
Westborough, MA
(508) 898-9220

Project #: GCN28873
Report to: HelenG@PhoenixLabs.com, Helen Geoghegan
Invoice to: AccountsPayable@PhoenixLabs.com
Quote#

Project P.O: GCN28873

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature _____ Date _____

Matrix Codes:
DW=Drinking Water GW=Ground Water SW=Surface Water WW=Waste Water
RW=Raw Water SE=Sediment SL=Sludge S=Soil SD=Solid W=Wipe
OIL=Oil B=Bulk L=Liquid

Analysis Request

Phoenix Sample ID	Sample Comment	Sample Matrix	Date Sampled	Time Sampled	PFAS (18) E537.1	250ml HDPE Plastic w/Trizma
CN28873		DW	1/24/2023	9:28 AM	x	2
CN28874	FD	DW	1/24/2023	9:29 AM	x	2

Relinquished by	Accepted by:	Date	Time:
	AAL	1/25/23	1057
AAL 1/25/23 1625		1/25/23	1625
		1/25/23	1835

Comments, Special Requirements or Regulations:

Please send notice as soon as possible not exceeding 24 hours of obtaining valid data, of the results of all drinking water samples that exceed any EPA or Department-established maximum contaminant level, maximum residual disinfectant level or reportable concentration

Please notify Phoenix Environmental Laboratories, Inc. immediately and prior to conducting analysis if certification is not held for the analytes requested.

Turnaround:
- ☐ 1 Day
- ☐ 2 Days
- ☐ 3 Days
- ☐ 5 Days
- ☐ 10 Days
- ☒ Standard
- ☐ Other ____

Report Type:
- ☒ Standard PDF
- ☐ Full Data Package
- ☐ NJ Reduced Deliverable
- ☐ NJ Full Deliverable
- ☐ NY ASP B

EDD Format:
- ☐ Excel
- ☐ GIS/Key
- ☐ FOutS
- ☐ NJ Hazsite EDD
- ☐ NY EZ EDD (ASP)
- ☐ Other ____

State Criteria:
MA DW

What State were samples collected?
MA

Page 24 of 28

Page 33 of 33

PHOENIX
Environmental Laboratories, Inc.

Wednesday, July 27, 2022

Attn: John Bonafini Jr.
Quabbin Analytical Lab
9 Stadler Street
Belchertown, MA 01007

Project ID: WARE WATER DIST., BARNES ST.
SDG ID: GCL81092
Sample ID#s: CL81092 - CL81093

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B
NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
UT Lab Registration #CT00007
VT Lab Registration #VT11301

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Sample Id Cross Reference

July 27, 2022

SDG I.D.: GCL81092

Project ID: WARE WATER DIST., BARNES ST.

Client Id	Lab Id	Matrix
PE 982-1	CL81092	DRINKING WATER
PE 982-2	CL81093	DRINKING WATER

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

July 27, 2022

FOR: Attn: John Bonafini Jr.
Quabbin Analytical Lab
9 Stadler Street
Belchertown, MA 01007

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		07/19/22	8:07
Location Code:	QUABBINFORDEP	Received by:	LB	07/19/22	16:24
Rush Request:	72 Hour	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCL81092
Phoenix ID: CL81092

Project ID: WARE WATER DIST., BARNES ST.
Client ID: PE 982-1

Parameter	Result		RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference	
PFAS (18)	Completed								07/22/22	***	537.1	C
PFAS (18)												
11Cl-PF3OUdS	ND		2	1	ng/L				07/25/22	***	537.1	C
9Cl-PF3ONS	ND		2	1	ng/L				07/25/22	***	537.1	C
ADONA	ND		2	1	ng/L				07/25/22	***	537.1	C
HFPO-DA	ND		2	1	ng/L				07/25/22	***	537.1	C
NEtFOSAA	ND		2	1	ng/L				07/25/22	***	537.1	C
NMeFOSAA	0.629	J	2	1	ng/L				07/25/22	***	537.1	C
Perfluorobutanesulfonic Acid (PFBS)	3.22		2	1	ng/L				07/25/22	***	537.1	C
Perfluorodecanoic Acid (PFDA)	ND		2	1	ng/L				07/25/22	***	537.1	C
Perfluorododecanoic Acid (PFDoA)	ND		2	1	ng/L				07/25/22	***	537.1	C
Perfluoroheptanoic Acid (PFHpA)	1.48	J	2	1	ng/L				07/25/22	***	537.1	C
Perfluorohexanesulfonic Acid (PFHxS)	2.15		2	1	ng/L				07/25/22	***	537.1	C
Perfluorohexanoic Acid (PFHxA)	2.33		2	1	ng/L				07/25/22	***	537.1	C
Perfluorononanoic Acid (PFNA)	ND		2	1	ng/L				07/25/22	***	537.1	C
Perfluorooctanesulfonic Acid (PFOS)	2.22		2	1	ng/L				07/25/22	***	537.1	C
Perfluorooctanoic Acid (PFOA)	3.59		2	1	ng/L				07/25/22	***	537.1	C
Perfluorotetradecanoic Acid (PFTA)	ND	Z	2	1	ng/L				07/25/22	***	537.1	C
Perfluorotridecanoic Acid (PFTrDA)	ND	Z	2	1	ng/L				07/25/22	***	537.1	C
Perfluoroundecanoic Acid (PFUnA)	ND		2	1	ng/L				07/25/22	***	537.1	C
QA/QC Surrogates												
% 13C3-HFPO-DA	127			1	%	NA	NA	NA	07/25/22	***	70 - 130 %	C
% 13C-PFDA	111			1	%	NA	NA	NA	07/25/22	***	70 - 130 %	C
% 13C-PFHxA	108			1	%	NA	NA	NA	07/25/22	***	70 - 130 %	C
% d5-NEtFOSA	104			1	%	NA	NA	NA	07/25/22	***	70 - 130 %	C

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.) AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances J=Estimated Below RL LOD=Limit of Detection MDL=Method Detection Limit1
QA/QC Surrogates: Surrogates are compounds (preceeded with a %) added by the lab to determine analysis efficiency. Surrogate results(%) listed in the report are not "detected" compounds.

Comments:

*See attached

PFAS (18) (537.1), PFAS Extraction (537.1) were analyzed by MA certified lab #M-MA030.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director
July 27, 2022
Reviewed and Released by: Helen Geoghegan, Project Manager

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

July 27, 2022

FOR: Attn: John Bonafini Jr.
Quabbin Analytical Lab
9 Stadler Street
Belchertown, MA 01007

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		07/19/22	8:07
Location Code:	QUABBINFORDEP	Received by:	LB	07/19/22	16:24
Rush Request:	72 Hour	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCL81092
Phoenix ID: CL81093

Project ID: WARE WATER DIST., BARNES ST.
Client ID: PE 982-2

Parameter	Result		RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference	
PFAS (18)	Completed								07/22/22	***	537.1	C
PFAS (18)												
11Cl-PF3OUdS	ND		2	1	ng/L				07/25/22	***	537.1	C
9Cl-PF3ONS	ND		2	1	ng/L				07/25/22	***	537.1	C
ADONA	ND		2	1	ng/L				07/25/22	***	537.1	C
HFPO-DA	ND	V	2	1	ng/L				07/25/22	***	537.1	C
NEtFOSAA	ND		2	1	ng/L				07/25/22	***	537.1	C
NMeFOSAA	ND		2	1	ng/L				07/25/22	***	537.1	C
Perfluorobutanesulfonic Acid (PFBS)	ND		2	1	ng/L				07/25/22	***	537.1	C
Perfluorodecanoic Acid (PFDA)	ND		2	1	ng/L				07/25/22	***	537.1	C
Perfluorododecanoic Acid (PFDoA)	ND		2	1	ng/L				07/25/22	***	537.1	C
Perfluoroheptanoic Acid (PFHpA)	ND		2	1	ng/L				07/25/22	***	537.1	C
Perfluorohexanesulfonic Acid (PFHxS)	ND		2	1	ng/L				07/25/22	***	537.1	C
Perfluorohexanoic Acid (PFHxA)	0.748	J	2	1	ng/L				07/25/22	***	537.1	C
Perfluorononanoic Acid (PFNA)	ND		2	1	ng/L				07/25/22	***	537.1	C
Perfluorooctanesulfonic Acid (PFOS)	ND		2	1	ng/L				07/25/22	***	537.1	C
Perfluorooctanoic Acid (PFOA)	ND		2	1	ng/L				07/25/22	***	537.1	C
Perfluorotetradecanoic Acid (PFTA)	ND		2	1	ng/L				07/25/22	***	537.1	C
Perfluorotridecanoic Acid (PFTrDA)	ND		2	1	ng/L				07/25/22	***	537.1	C
Perfluoroundecanoic Acid (PFUnA)	ND		2	1	ng/L				07/25/22	***	537.1	C
QA/QC Surrogates												
% 13C3-HFPO-DA	135	Q		1	%	NA	NA	NA	07/25/22	***	70 - 130 %	C
% 13C-PFDA	121			1	%	NA	NA	NA	07/25/22	***	70 - 130 %	C
% 13C-PFHxA	115			1	%	NA	NA	NA	07/25/22	***	70 - 130 %	C
% d5-NEtFOSA	112			1	%	NA	NA	NA	07/25/22	***	70 - 130 %	C

Project ID: WARE WATER DIST., BARNES ST.
Client ID: PE 982-2

Phoenix I.D.: CL81093

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

3 = This parameter exceeds laboratory specified limits.
C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances J=Estimated Below RL LOD=Limit of Detection MDL=Method Detection Limit1
QA/QC Surrogates: Surrogates are compounds (preceeded with a %) added by the lab to determine analysis efficiency. Surrogate results(%) listed in the report are not "detected" compounds.

Comments:

*See attached

PFAS (18) (537.1), PFAS Extraction (537.1) were analyzed by MA certified lab #M-MA030.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director
July 27, 2022
Reviewed and Released by: Helen Geoghegan, Project Manager

Wednesday, July 27, 2022

Criteria: MA, DW

State: MA

Sample Criteria Exceedances Report

GCL81092 - QUABBINFORDEP

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units

*** No Data to Display ***

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies) A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

ACCREDITED IN ACCORDANCE WITH nelac
NY # 11301

Analysis Comments

July 27, 2022

SDG I.D.: GCL81092

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

PWSID 1309000 LOC: 10011 (BS) (Com)

Cooler: Yes ☑ No ☐
Coolant: IPK ☑ ICE ☐ No ☐

PHOENIX
Environmental Laboratories, Inc.

CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email Makrina Nolan: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 2.2 °C Pg of

Data Delivery/Contact Options:
☐ Fax:
☐ Phone:
☐ Email:

Customer:
Address: QUABBIN ANALYTICAL LABORATORY
9 STADLER ST
BELCHERTOWN, MA 01007

Project: Ware Water Dist. - Barnes St. Project P.O:
Report to:
Invoice to:
QUOTE #

FOR DEP

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature _____ Date: _____

Matrix Code:
DW=Drinking Water GW=Ground Water SW=Surface Water WW=Waste Water
RW=Raw Water SE=Sediment SL=Sludge S=Soil SD=Solid W=Wipe OIL=Oil
B=Bulk L=Liquid X = _____(Other)

Analysis Request: PFAS Method (537.1 Full Method)

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	MS/MSD*	GL Amber 8 oz. [ ] H3PO4 [ ] NAHSO4	Soil VOA Vials [ ] Methanol [ ] H2O	GL Soil container ( ) oz	GL Soil container ( ) oz	40 ml VOA Vial [ ] As is [ ] HCL	GL Amber 1000ml [ ] As is [ ] H2SO4	Pt. As is [ ] 250ml [ ] 500ml [ ] 1000ml	Pt. H2SO4 [ ] 250ml [ ] 500ml	Pt. HNO3 250ml	Pt. NaOH 250ml	Bacteria Bottle w/Na	Bacteria Bottle as is
81092	PE982-1	DW	7/19/22	8:07A	X							2					
81093	PE982-2	FB	"	"	X							2					

Relinquished by:	Accepted by:	Date:	Time:
		7-19-22	1326
		7-19-22	1624

Comments, Special Requirements or Regulations:

**MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.*

Turnaround Time:
☐ 1 Day*
☐ 2 Days*
☐ 3 Days*
☐ Standard
☐ Other
* SURCHARGE APPLIES

RI
☐ (Residential) Direct Exposure
☐ (Comm/Industrial) Direct Exposure
☐ GA Leachability
☐ GB Leachability
☐ GA-GW Objectives
☐ GB-GW Objectives

CT
☐ RCP Cert
☐ GW Protection
☐ SW Protection
☐ GA Mobility
☐ GB Mobility
☐ Residential DEC
☐ I/C DEC
☐ Other

MA
☐ MCP Certification
☐ GW-1 ☐ MWRA eSMART
☐ GW-2 ☐ S-1 10% CALC
☐ GW-3
☐ S-1 GW-1 ☐ S-1 GW-2 ☐ S-1 GW-3
☐ S-2 GW-1 ☐ S-2 GW-2 ☐ S-2 GW-3
☐ S-3 GW-1 ☐ S-3 GW-2 ☐ S-3 GW-3
☐ SW Protection

State where samples were collected: _____

Data Format
☐ Excel
☐ PDF
☐ GIS/Key
☐ EQuIS
☐ Other

Data Package
☐ Tier II Checklist
☐ Full Data Package*
☐ Phoenix Std Report
☐ Other
* SURCHARGE APPLIES

PEL-126 REV 03/22

ALPHA ANALYTICAL

ANALYTICAL REPORT

Lab Number:	L2238603
Client:	Phoenix Environmental Labs 587 East Middle Turnpike P.O. Box 370 Manchester, CT 06040
ATTN:	Helen Geoghegan
Phone:	(860) 645-8726
Project Name:	GCL81092
Project Number:	Not Specified
Report Date:	07/26/22

Certifications & Approvals: MA (M-MA030), NH NELAP (2062), CT (PH-0141), DoD (L2474), FL (E87814), IL (200081), LA (85084), ME (MA00030), MD (350), NJ (MA015), NY (11627), NC (685), OH (CL106), PA (68-02089), RI (LAO00299), TX (T104704419), VT (VT-0015), VA (460194), WA (C954), US Army Corps of Engineers, USDA (Permit #P330-17-00150), USFWS (Permit #206964).

320 Forbes Boulevard, Mansfield, MA 02048-1806
508-822-9300 (Fax) 508-822-3288 800-624-9220 - www.alphalab.com

Project Name: GCL81092
Project Number: Not Specified

Lab Number: L2238603
Report Date: 07/26/22

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2238603-01	CL81092	DW	MA	07/19/22 08:07	07/20/22
L2238603-02	CL81093 FB	DW	MA	07/19/22 08:07	07/20/22

Project Name:	GCL81092	**Lab Number:**	L2238603
Project Number:	Not Specified	**Report Date:**	07/26/22

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name: GCL81092 **Lab Number:** L2238603
Project Number: Not Specified **Report Date:** 07/26/22

Case Narrative (continued)

Report Submission

All non-detect (ND) or estimated concentrations (J-qualified) have been quantitated to the limit noted in the MDL column.

Perfluorinated Alkyl Acids by EPA 537.1

L2238603-02: The surrogate recovery is above the acceptance criteria for 2,3,3,3-tetrafluoro-2-[1,1,2,2,3,3,3-heptafluoropropoxy]-13c3-propanoic acid (m3hfpo-da) (135%). Since the sample was non-detect for all target analytes, re-analysis was not required.

WG1666345-2R: The sample was re-analyzed due to QC failures in the original analysis. The results of the re-analysis are reported.

The WG1666345-2R LCS recovery, associated with L2238603-01 and -02, is above the acceptance criteria for perfluorononanoic acid (pfna) (137%), perfluorodecanoic acid (pfda) (132%), perfluoroundecanoic acid (pfuna) (131%) and perfluorotridecanoic acid (pftrda) (132%); however, the associated samples are non-detect to the RL for these target analytes. The results of the original analysis are reported.

WG1666345-2R: The surrogate recovery is above the acceptance criteria for 2,3,3,3-tetrafluoro-2-[1,1,2,2,3,3,3-heptafluoropropoxy]-13c3-propanoic acid (m3hfpo-da) (132%) and n-deuterioethylperfluoro-1-octanesulfonamidoacetic acid (d5-netfosaa) (135%).

The WG1666345-3 MS recoveries, performed on L2238603-01, are outside the acceptance criteria for perfluorotridecanoic acid (pftrda) (134%) and perfluorotetradecanoic acid (pfta) (172%).

The surrogate recoveries for the WG1666345-3 MS, associated with L2238603-01 and -02, are outside the acceptance criteria for 2,3,3,3-tetrafluoro-2-[1,1,2,2,3,3,3-heptafluoropropoxy]-13c3-propanoic acid (m3hfpo-da) (140%).

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature:  Alycia Mogayzel

Title: Technical Director/Representative Date: 07/26/22

ORGANICS

SEMIVOLATILES

Project Name: GCL81092
Project Number: Not Specified

Lab Number: L2238603
Report Date: 07/26/22

SAMPLE RESULTS

Lab ID: L2238603-01
Client ID: CL81092
Sample Location: MA

Date Collected: 07/19/22 08:07
Date Received: 07/20/22
Field Prep: Not Specified

Sample Depth:
Matrix: Dw
Analytical Method: 133,537.1
Analytical Date: 07/25/22 13:04
Analyst: JW

Extraction Method: EPA 537.1
Extraction Date: 07/22/22 15:48

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab						
Perfluorobutanesulfonic Acid (PFBS)	3.22		ng/l	2.00	0.618	1
Perfluorohexanoic Acid (PFHxA)	2.33		ng/l	2.00	0.618	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND		ng/l	2.00	0.618	1
Perfluoroheptanoic Acid (PFHpA)	1.48	J	ng/l	2.00	0.618	1
Perfluorohexanesulfonic Acid (PFHxS)	2.15		ng/l	2.00	0.618	1
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	0.618	1
Perfluorooctanoic Acid (PFOA)	3.59		ng/l	2.00	0.618	1
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	0.618	1
Perfluorooctanesulfonic Acid (PFOS)	2.22		ng/l	2.00	0.618	1
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	0.618	1
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	0.618	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	0.629	J	ng/l	2.00	0.618	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	0.618	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	0.618	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	0.618	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	0.618	1
Perfluorotridecanoic Acid (PFTrDA)	ND	Z	ng/l	2.00	0.618	1
Perfluorotetradecanoic Acid (PFTA)	ND	Z	ng/l	2.00	0.618	1
PFAS, Total (6)	7.96		ng/l	2.00	0.618	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	108		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	127		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	111		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	104		70-130

Project Name: GCL81092
Project Number: Not Specified

Lab Number: L2238603
Report Date: 07/26/22

SAMPLE RESULTS

Lab ID: L2238603-02
Client ID: CL81093 FB
Sample Location: MA

Date Collected: 07/19/22 08:07
Date Received: 07/20/22
Field Prep: Not Specified

Sample Depth:
Matrix: Dw
Analytical Method: 133,537.1
Analytical Date: 07/25/22 13:33
Analyst: JW

Extraction Method: EPA 537.1
Extraction Date: 07/22/22 15:48

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab						
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	2.00	0.625	1
Perfluorohexanoic Acid (PFHxA)	0.748	J	ng/l	2.00	0.625	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND	V	ng/l	2.00	0.625	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	2.00	0.625	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	2.00	0.625	1
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	0.625	1
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	0.625	1
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	0.625	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	0.625	1
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	0.625	1
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	0.625	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	2.00	0.625	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	0.625	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	0.625	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	0.625	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	0.625	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	2.00	0.625	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	2.00	0.625	1
PFAS, Total (6)	ND		ng/l	2.00	0.625	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	115		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	135	Q	70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	121		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	112		70-130

Project Name: GCL81092 **Lab Number:** L2238603

Project Number: Not Specified **Report Date:** 07/26/22

Method Blank Analysis
Batch Quality Control

Analytical Method: 133,537.1
Analytical Date: 07/25/22 12:46
Analyst: JW

Extraction Method: EPA 537.1
Extraction Date: 07/22/22 15:48

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab for sample(s): 01-02 Batch: WG1666345-1					
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	2.00	0.668
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	2.00	0.668
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND		ng/l	2.00	0.668
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	2.00	0.668
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	2.00	0.668
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	0.668
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	0.668
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	0.668
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	0.668
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	0.668
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	0.668
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	2.00	0.668
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	0.668
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	0.668
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	0.668
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	0.668
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	2.00	0.668
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	2.00	0.668
PFAS, Total (6)	ND		ng/l	2.00	0.668

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	106		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	124		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	110		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	109		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: GCL81092
Project Number: Not Specified

Lab Number: L2238603
Report Date: 07/26/22

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 Batch: WG1666345-2								
Perfluorobutanesulfonic Acid (PFBS)	106		-		70-130	-		30
Perfluorohexanoic Acid (PFHxA)	118		-		70-130	-		30
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	116		-		70-130	-		30
Perfluoroheptanoic Acid (PFHpA)	122		-		70-130	-		30
Perfluorohexanesulfonic Acid (PFHxS)	105		-		70-130	-		30
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	115		-		70-130	-		30
Perfluorooctanoic Acid (PFOA)	119		-		70-130	-		30
Perfluorononanoic Acid (PFNA)	137	Q	-		70-130	-		30
Perfluorooctanesulfonic Acid (PFOS)	105		-		70-130	-		30
Perfluorodecanoic Acid (PFDA)	132	Q	-		70-130	-		30
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	84		-		70-130	-		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	110		-		70-130	-		30
Perfluoroundecanoic Acid (PFUnA)	131	Q	-		70-130	-		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	110		-		70-130	-		30
Perfluorododecanoic Acid (PFDoA)	124		-		70-130	-		30
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	90		-		70-130	-		30
Perfluorotridecanoic Acid (PFTrDA)	132	Q	-		70-130	-		30
Perfluorotetradecanoic Acid (PFTA)	115		-		70-130	-		30

Lab Control Sample Analysis
Batch Quality Control

Project Name: GCL81092
Project Number: Not Specified

Lab Number: L2238603
Report Date: 07/26/22

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 Batch: WG1666345-2								

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	129				70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	132	Q			70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	122				70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	135	Q			70-130

Matrix Spike Analysis
Batch Quality Control

Project Name: GCL81092
Project Number: Not Specified

Lab Number: L2238603
Report Date: 07/26/22

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab	Associated sample(s): 01-02	QC Batch ID: WG1666345-3				QC Sample: L2238603-01			Client ID: CL81092			
Perfluorobutanesulfonic Acid (PFBS)	3.22	32.7	40.0	112		-	-		70-130	-		30
Perfluorohexanoic Acid (PFHxA)	2.33	36.9	44.5	114		-	-		70-130	-		30
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND	36.9	46.1	125		-	-		70-130	-		30
Perfluoroheptanoic Acid (PFHpA)	1.48J	36.9	45.5	123		-	-		70-130	-		30
Perfluorohexanesulfonic Acid (PFHxS)	2.15	33.7	41.4	116		-	-		70-130	-		30
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND	34.8	43.9	126		-	-		70-130	-		30
Perfluorooctanoic Acid (PFOA)	3.59	36.9	51.1	129		-	-		70-130	-		30
Perfluorononanoic Acid (PFNA)	ND	36.9	46.5	126		-	-		70-130	-		30
Perfluorooctanesulfonic Acid (PFOS)	2.22	34.2	40.0	110		-	-		70-130	-		30
Perfluorodecanoic Acid (PFDA)	ND	36.9	45.9	124		-	-		70-130	-		30
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND	34.4	42.6	124		-	-		70-130	-		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	0.629J	36.9	40.2	109		-	-		70-130	-		30
Perfluoroundecanoic Acid (PFUnA)	ND	36.9	44.9	122		-	-		70-130	-		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND	36.9	40.8	111		-	-		70-130	-		30
Perfluorododecanoic Acid (PFDoA)	ND	36.9	44.0	119		-	-		70-130	-		30
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND	34.8	42.3	122		-	-		70-130	-		30
Perfluorotridecanoic Acid (PFTrDA)	NDZ	36.9	49.4	134	Q	-	-		70-130	-		30
Perfluorotetradecanoic Acid (PFTA)	NDZ	36.9	63.4	172	Q	-	-		70-130	-		30

Matrix Spike Analysis
Batch Quality Control

Project Name: GCL81092
Project Number: Not Specified
Lab Number: L2238603
Report Date: 07/26/22

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab	Associated sample(s): 01-02	QC Batch ID: WG1666345-3	QC Sample: L2238603-01	Client ID: CL81092								

Surrogate	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	118				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	126				70-130
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	116				70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	140	Q			70-130

Lab Duplicate Analysis
Batch Quality Control

Project Name: GCL81092
Project Number: Not Specified

Lab Number: L2238603
Report Date: 07/26/22

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 QC Batch ID: WG1666345-4 QC Sample: L2238673-01 Client ID: DUP Sample						
Perfluorobutanesulfonic Acid (PFBS)	0.721J	0.718J	ng/l	NC		30
Perfluorohexanoic Acid (PFHxA)	0.721J	0.718J	ng/l	NC		30
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid (HFPO-DA)	ND	ND	ng/l	NC		30
Perfluoroheptanoic Acid (PFHpA)	ND	ND	ng/l	NC		30
Perfluorohexanesulfonic Acid (PFHxS)	0.652J	0.650J	ng/l	NC		30
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND	ND	ng/l	NC		30
Perfluorooctanoic Acid (PFOA)	0.687J	0.650J	ng/l	NC		30
Perfluorononanoic Acid (PFNA)	ND	ND	ng/l	NC		30
Perfluorooctanesulfonic Acid (PFOS)	0.721J	0.684J	ng/l	NC		30
Perfluorodecanoic Acid (PFDA)	ND	ND	ng/l	NC		30
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND	ND	ng/l	NC		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND	ND	ng/l	NC		30
Perfluoroundecanoic Acid (PFUnA)	ND	ND	ng/l	NC		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND	ND	ng/l	NC		30
Perfluorododecanoic Acid (PFDoA)	ND	ND	ng/l	NC		30
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND	ND	ng/l	NC		30
Perfluorotridecanoic Acid (PFTrDA)	ND	ND	ng/l	NC		30
Perfluorotetradecanoic Acid (PFTA)	ND	ND	ng/l	NC		30

Lab Duplicate Analysis
Batch Quality Control

Project Name: GCL81092
Project Number: Not Specified

Lab Number: L2238603
Report Date: 07/26/22

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits

Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 QC Batch ID: WG1666345-4 QC Sample: L2238673-01 Client ID: DUP Sample

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	104		111		70-130
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-13C3-Propanoic Acid (M3HFPO-DA)	123		127		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	106		111		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	104		103		70-130

Project Name: GCL81092
Project Number: Not Specified

Lab Number: L2238603
Report Date: 07/26/22

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2238603-01A	Plastic 250ml Trizma preserved	A	NA		5.3	Y	Absent		A2-MA-537.1(14)
L2238603-01B	Plastic 250ml Trizma preserved	A	NA		5.3	Y	Absent		A2-MA-537.1(14)
L2238603-02A	Plastic 250ml Trizma preserved	A	NA		5.3	Y	Absent		A2-MA-537.1(14)

*Values in parentheses indicate holding time in days

PFAS PARAMETER SUMMARY

Parameter	Acronym	CAS Number
PERFLUOROALKYL CARBOXYLIC ACIDS (PFCAs)		
Perfluorooctadecanoic Acid	PFODA	16517-11-6
Perfluorohexadecanoic Acid	PFHxDA	67905-19-5
Perfluorotetradecanoic Acid	PFTA	376-06-7
Perfluorotridecanoic Acid	PFTrDA	72629-94-8
Perfluorododecanoic Acid	PFDoA	307-55-1
Perfluoroundecanoic Acid	PFUnA	2058-94-8
Perfluorodecanoic Acid	PFDA	335-76-2
Perfluorononanoic Acid	PFNA	375-95-1
Perfluorooctanoic Acid	PFOA	335-67-1
Perfluoroheptanoic Acid	PFHpA	375-85-9
Perfluorohexanoic Acid	PFHxA	307-24-4
Perfluoropentanoic Acid	PFPeA	2706-90-3
Perfluorobutanoic Acid	PFBA	375-22-4
PERFLUOROALKYL SULFONIC ACIDS (PFSAs)		
Perfluorododecanesulfonic Acid	PFDoDS	79780-39-5
Perfluorodecanesulfonic Acid	PFDS	335-77-3
Perfluorononanesulfonic Acid	PFNS	68259-12-1
Perfluorooctanesulfonic Acid	PFOS	1763-23-1
Perfluoroheptanesulfonic Acid	PFHpS	375-92-8
Perfluorohexanesulfonic Acid	PFHxS	355-46-4
Perfluoropentanesulfonic Acid	PFPeS	2706-91-4
Perfluorobutanesulfonic Acid	PFBS	375-73-5
FLUOROTELOMERS		
1H,1H,2H,2H-Perfluorododecanesulfonic Acid	10:2FTS	120226-60-0
1H,1H,2H,2H-Perfluorodecanesulfonic Acid	8:2FTS	39108-34-4
1H,1H,2H,2H-Perfluorooctanesulfonic Acid	6:2FTS	27619-97-2
1H,1H,2H,2H-Perfluorohexanesulfonic Acid	4:2FTS	757124-72-4
PERFLUOROALKANE SULFONAMIDES (FASAs)		
Perfluorooctanesulfonamide	FOSA	754-91-6
N-Ethyl Perfluorooctane Sulfonamide	NEtFOSA	4151-50-2
N-Methyl Perfluorooctane Sulfonamide	NMeFOSA	31506-32-8
PERFLUOROALKANE SULFONYL SUBSTANCES		
N-Ethyl Perfluorooctanesulfonamido Ethanol	NEtFOSE	1691-99-2
N-Methyl Perfluorooctanesulfonamido Ethanol	NMeFOSE	24448-09-7
N-Ethyl Perfluorooctanesulfonamidoacetic Acid	NEtFOSAA	2991-50-6
N-Methyl Perfluorooctanesulfonamidoacetic Acid	NMeFOSAA	2355-31-9
PER- and POLYFLUOROALKYL ETHER CARBOXYLIC ACIDS		
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid	HFPO-DA	13252-13-6
4,8-Dioxa-3h-Perfluorononanoic Acid	ADONA	919005-14-4
CHLORO-PERFLUOROALKYL SULFONIC ACIDS		
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1
PERFLUOROETHER SULFONIC ACIDS (PFESAs)		
Perfluoro(2-Ethoxyethane)Sulfonic Acid	PFEESA	113507-82-7
PERFLUOROETHER/POLYETHER CARBOXYLIC ACIDS (PFPCAs)		
Perfluoro-3-Methoxypropanoic Acid	PFMPA	377-73-1
Perfluoro-4-Methoxybutanoic Acid	PFMBA	863090-89-5
Nonafluoro-3,6-Dioxaheptanoic Acid	NFDHA	151772-58-6

Project Name: GCL81092 **Lab Number:** L2238603

Project Number: Not Specified **Report Date:** 07/26/22

GLOSSARY

Acronyms

DL - Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

EDL - Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).

EMPC - Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.

EPA - Environmental Protection Agency.

LCS - Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LCSD - Laboratory Control Sample Duplicate: Refer to LCS.

LFB - Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LOD - Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

LOQ - Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

MDL - Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

MS - Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.

MSD - Matrix Spike Sample Duplicate: Refer to MS.

NA - Not Applicable.

NC - Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.

NDPA/DPA - N-Nitrosodiphenylamine/Diphenylamine.

NI - Not Ignitable.

NP - Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.

NR - No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.

RL - Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

RPD - Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.

SRM - Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.

STLP - Semi-dynamic Tank Leaching Procedure per EPA Method 1315.

TEF - Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.

TEQ - Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.

TIC - Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Report Format: DU Report with 'J' Qualifiers

Project Name:	GCL81092	**Lab Number:**	L2238603
Project Number:	Not Specified	**Report Date:**	07/26/22

Footnotes

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Chlordane: The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Gasoline Range Organics (GRO): Gasoline Range Organics (GRO) results include all chromatographic peaks eluting from Methyl tert butyl ether through Naphthalene, with the exception of GRO analysis in support of State of Ohio programs, which includes all chromatographic peaks eluting from Hexane through Dodecane.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW compliance analysis only, the 'PFAS, Total (6)' result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. The Target analyte concentration is below the quantitation limit (RL), but above the Method Detection Limit (MDL) or Estimated Detection Limit (EDL) for SPME-related analyses. This represents an estimated concentration for Tentatively

Report Format: DU Report with 'J' Qualifiers

Project Name:	GCL81092	**Lab Number:**	L2238603
Project Number:	Not Specified	**Report Date:**	07/26/22

Data Qualifiers

Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

ND - Not detected at the method detection limit (MDL) for the sample, or estimated detection limit (EDL) for SPME-related analyses.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

V - The surrogate associated with this target analyte has a recovery outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Z - The batch matrix spike and/or duplicate associated with this target analyte has a recovery/RPD outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Report Format: DU Report with 'J' Qualifiers

Project Name:	GCL81092	**Lab Number:**	L2238603
Project Number:	Not Specified	**Report Date:**	07/26/22

REFERENCES

133 Determination of Selected Per- and Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). EPA Method 537.1, EPA/600/R-18/352. Version 1.0, November 2018.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624/624.1: m/p-xylene, o-xylene, Naphthalene
EPA 625/625.1: alpha-Terpineol
EPA 8260C/8260D: NPW: 1,2,4,5-Tetramethylbenzene, 4-Ethyltoluene, Azobenzene, SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene, 4-Ethyltoluene.
EPA 8270D/8270E: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine, alpha-Terpineol, SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility
SM 2540D: TSS
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2:** Nitrate-N, Nitrite-N; **SM4500NO3-F:** Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N; **EPA 350.1:** Ammonia-N; **LACHAT 10-107-06-1-B:** Ammonia-N; **EPA 351.1, SM4500NO3-F, EPA 353.2:** Nitrate-N; **SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics.
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables); **EPA 600/4-81-045:** PCB-Oil.
Microbiology: SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603, SM9222D.

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522, EPA 537.1.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb, As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

L2238603

Cooler: Yes ☐ No ☐
Coolant: IPK ☐ ICE ☐ No ☐
Temp °C Pg of

PHOENIX
Environmental Laboratories, Inc.

CHAIN OF CUSTODY RECORD

Page 1 of 1

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Project #: GCL81092
Report to: HelenG@PhoenixLabs.com / Helen Geonhegan
Invoice to: AccountsPayable@PhoenixLabs.com
Quote# :

Project P.O: GCL81092

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature _____ Date: _____

Matrix Code:
DW=Drinking Water GW=Ground Water SW=Surface Water WW=Waste Water
RW=Raw Water SE=Sediment SL=Sludge S=Soil SD=Solid W=Wipe
OIL=Oil B=Bulk L=Liquid

Analysis Request

Phoenix Sample ID	Sample Comment	Sample Matrix	Date Sampled	Time Sampled	PFAS (18) E537.1	250ml HDPE Plastic wTrizma
CL81092		DW	7/19/2022	8:07 AM	x	2
CL81093	FB	DW	7/19/2022	8:07 AM	x	2

Relinquished by:	Accepted by:	Date:	Time:
		7-20-22	11
		7/20/22	16
		7/20/22	2000

Comments, Special Requirements or Regulations:

Please send notice as soon as possible not exceeding 24 hours of obtaining valid data, of the results of all drinking water samples that exceed any EPA or Department-established maximum contaminant level, maximum residual disinfectant level or reportable concentration.

Please notify Phoenix Environmental Laboratories, Inc. immediately and prior to conducting analysis if certification is not held for the analyses requested.

Turnaround:
☐ 1 Day
☐ 2 Days
☐ 3 Days
☐ 5 Days
☐ 10 Days
☒ Standard
☐ Other _____

Report Type:
☒ Standard PDF
☐ Full Data Package
☐ NJ Reduced Deliverable
☐ NJ Full Deliverable
☐ NY ASP B

EDD Format:
☐ Excel
☐ GIS/Key
☐ EQuIS
☐ NJ Hazsite EDD
☐ NY EZ EDD (ASP)
☐ Other _____

State Criteria:
MA: DW

What State were samples collected?
MA

PHOENIX
Environmental Laboratories, Inc.

Wednesday, July 27, 2022

Attn: John Bonafini Jr.
Quabbin Analytical Lab
9 Stadler Street
Belchertown, MA 01007

Project ID: WARE WATER DIST., DISMAL SWAMP
SDG ID: GCL81090
Sample ID#s: CL81090 - CL81091

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B
NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
UT Lab Registration #CT00007
VT Lab Registration #VT11301

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Sample Id Cross Reference

July 27, 2022

SDG I.D.: GCL81090

Project ID: WARE WATER DIST., DISMAL SWAMP

Client Id	Lab Id	Matrix
PE 981-1	CL81090	DRINKING WATER
PE 981-2	CL81091	DRINKING WATER

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

July 27, 2022

FOR: Attn: John Bonafini Jr.
Quabbin Analytical Lab
9 Stadler Street
Belchertown, MA 01007

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		07/19/22	9:01
Location Code:	QUABBINFORDEP	Received by:	LB	07/19/22	16:24
Rush Request:	72 Hour	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCL81090
Phoenix ID: CL81090

Project ID: WARE WATER DIST., DISMAL SWAMP
Client ID: PE 981-1

Parameter	Result		RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference	
PFAS (18)	Completed								07/23/22	***	537.1	C
PFAS (18)												
11Cl-PF3OUdS	ND		2.00	1	ng/L				07/25/22	***	537.1	C
9Cl-PF3ONS	ND		2.00	1	ng/L				07/25/22	***	537.1	C
ADONA	ND		2.00	1	ng/L				07/25/22	***	537.1	C
HFPO-DA	ND		2.00	1	ng/L				07/25/22	***	537.1	C
NEtFOSAA	ND		2.00	1	ng/L				07/25/22	***	537.1	C
NMeFOSAA	ND		2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorobutanesulfonic Acid (PFBS)	ND		2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorodecanoic Acid (PFDA)	ND		2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorododecanoic Acid (PFDoA)	ND		2.00	1	ng/L				07/25/22	***	537.1	C
Perfluoroheptanoic Acid (PFHpA)	ND		2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorohexanesulfonic Acid (PFHxS)	2.33		2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorohexanoic Acid (PFHxA)	ND		2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorononanoic Acid (PFNA)	ND		2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorooctanesulfonic Acid (PFOS)	3.97		2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorooctanoic Acid (PFOA)	0.993	J	2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorotetradecanoic Acid (PFTA)	ND		2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorotridecanoic Acid (PFTrDA)	ND		2.00	1	ng/L				07/25/22	***	537.1	C
Perfluoroundecanoic Acid (PFUnA)	ND		2.00	1	ng/L				07/25/22	***	537.1	C
QA/QC Surrogates												
% 13C3-HFPO-DA	96.0			1	%	NA	NA	NA	07/25/22	***	70 - 130 %	C
% 13C-PFDA	98.0			1	%	NA	NA	NA	07/25/22	***	70 - 130 %	C
% 13C-PFHxA	101			1	%	NA	NA	NA	07/25/22	***	70 - 130 %	C
% d5-NEtFOSA	86.0			1	%	NA	NA	NA	07/25/22	***	70 - 130 %	C

Project ID: WARE WATER DIST., DISMAL SWAMP
Client ID: PE 981-1

Phoenix I.D.: CL81090

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances J=Estimated Below RL LOD=Limit of Detection MDL=Method Detection Limit1
QA/QC Surrogates: Surrogates are compounds (preceeded with a %) added by the lab to determine analysis efficiency. Surrogate results(%) listed in the report are not "detected" compounds.

Comments:

*See attached

PFAS (18) (537.1), PFAS Extraction (537.1) were analyzed by MA certified lab #M-MA030.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director
July 27, 2022
Reviewed and Released by: Helen Geoghegan, Project Manager

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

July 27, 2022

FOR: Attn: John Bonafini Jr.
Quabbin Analytical Lab
9 Stadler Street
Belchertown, MA 01007

Sample Information		Custody Information		Date	Time
Matrix:	DRINKING WATER	Collected by:		07/19/22	9:01
Location Code:	QUABBINFORDEP	Received by:	LB	07/19/22	16:24
Rush Request:	72 Hour	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GCL81090
Phoenix ID: CL81091

Project ID: WARE WATER DIST., DISMAL SWAMP
Client ID: PE 981-2

Parameter	Result	RL/ PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference	
PFAS (18)	Completed							07/23/22	***	537.1	C
PFAS (18)											
11Cl-PF3OUdS	ND	2.00	1	ng/L				07/25/22	***	537.1	C
9Cl-PF3ONS	ND	2.00	1	ng/L				07/25/22	***	537.1	C
ADONA	ND	2.00	1	ng/L				07/25/22	***	537.1	C
HFPO-DA	ND	2.00	1	ng/L				07/25/22	***	537.1	C
NEtFOSAA	ND	2.00	1	ng/L				07/25/22	***	537.1	C
NMeFOSAA	ND	2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorobutanesulfonic Acid (PFBS)	ND	2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorodecanoic Acid (PFDA)	ND	2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorododecanoic Acid (PFDoA)	ND	2.00	1	ng/L				07/25/22	***	537.1	C
Perfluoroheptanoic Acid (PFHpA)	ND	2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorohexanesulfonic Acid (PFHxS)	ND	2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorohexanoic Acid (PFHxA)	ND	2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorononanoic Acid (PFNA)	ND	2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorooctanesulfonic Acid (PFOS)	ND	2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorooctanoic Acid (PFOA)	ND	2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorotetradecanoic Acid (PFTA)	ND	2.00	1	ng/L				07/25/22	***	537.1	C
Perfluorotridecanoic Acid (PFTrDA)	ND	2.00	1	ng/L				07/25/22	***	537.1	C
Perfluoroundecanoic Acid (PFUnA)	ND	2.00	1	ng/L				07/25/22	***	537.1	C
QA/QC Surrogates											
% 13C3-HFPO-DA	104		1	%	NA	NA	NA	07/25/22	***	70 - 130 %	C
% 13C-PFDA	101		1	%	NA	NA	NA	07/25/22	***	70 - 130 %	C
% 13C-PFHxA	106		1	%	NA	NA	NA	07/25/22	***	70 - 130 %	C
% d5-NEtFOSA	97.0		1	%	NA	NA	NA	07/25/22	***	70 - 130 %	C

Parameter	Result	RL/PQL	DIL	Units	AL	MCL	Other	Date/Time	By	Reference

C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level DIL=Dilution (analysis required diluting to evaluate) ND=Not Detected
BRL=Below Reporting Level (less than the reporting level, the lowest amount the laboratory can detect and report.)
AL = Action Level MCL = Maximum Contaminant Level Other = Other Goals or Guidances LOD=Limit of Detection
MDL=Method Detection Limit1
QA/QC Surrogates: Surrogates are compounds (preceeded with a %) added by the lab to determine analysis efficiency. Surrogate results(%) listed in the report are not "detected" compounds.

Comments:

*See attached

PFAS (18) (537.1), PFAS Extraction (537.1) were analyzed by MA certified lab #M-MA030.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director
July 27, 2022
Reviewed and Released by: Helen Geoghegan, Project Manager

Wednesday, July 27, 2022

Criteria: MA: DW

State: MA

Sample Criteria Exceedances Report

GCL81090 - QUABBINFORDEP

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units

*** No Data to Display ***

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

ACCREDITED IN ACCORDANCE WITH nelac
NY # 11301

Analysis Comments

July 27, 2022 SDG I.D.: GCL81090

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

PWSID 1209000 Loc: 10010 (RS) (COM)

Cooler: Yes ☑ No ☐
Coolant: IPK ☑ ICE ☐ No ☐

PHOENIX
Environmental Laboratories, Inc.

CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email Makrina Nolan: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 2.2 °C Pg of

Data Delivery/Contact Options:
☐ Fax:
☐ Phone:
☐ Email:

Customer: QUABBIN ANALYTICAL LABORATORY
Address: 9 STADLER ST
BELCHERTOWN, MA 01007

Project: Ware Water Dist. - Dismal Swamp Project P.O:
Report to:
Invoice to:
QUOTE #

FOR DE!)

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature _____ Date: _____

Matrix Code:
DW=Drinking Water GW=Ground Water SW=Surface Water WW=Waste Water
RW=Raw Water SE=Sediment SL=Sludge S=Soil SD=Solid W=Wipe OIL=Oil
B=Bulk L=Liquid X = _____(Other)

Analysis Request

PFAS 537.1 (Full Method)

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	MS/MSD*	GL Amber 8 oz. [ ] H3PO4 [ ] NAHSO4	Soil VOA Vials [ ] methanol [ ] H2O	GL Soil container ( ) oz	GL Soil container ( ) oz	40 ml VOA Vial [ ] As is [ ] HCL	GL Amber 1000ml [ ] As is [ ] H2SO4	PL As is [ ] 250ml [ ] 500ml [ ] 1000ml	PL H2SO4 [ ] 250ml [ ] 500ml	PL HNO3 250ml	PL NaOH 250ml	Bacteria Bottle w/hypo	Bacteria Bottle as is
81090	PE 981-1	DW	7/19/22	9:01	X							2					
81091	PE 981-2	FB	"	9:01	X							2					

Relinquished by:	Accepted by:	Date:	Time:
		7-19-22	1310
		7-19-22	1624

Comments, Special Requirements or Regulations:

Turnaround Time:
☐ 1 Day*
☐ 2 Days*
☐ 3 Days*
☐ Standard
☐ Other
* SURCHARGE APPLIES

*MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.

RI
☐ (Residential) Direct Exposure
☐ (Comm/Industrial) Direct Exposure
☐ GA Leachability
☐ GB Leachability
☐ GA-GW Objectives
☐ GB-GW Objectives

CT
☐ RCP Cert
☐ GW Protection
☐ SW Protection
☐ GA Mobility
☐ GB Mobility
☐ Residential DEC
☐ I/C DEC
☐ Other

MA
☐ MCP Certification
☐ GW-1 ☐ MWRA eSMART
☐ GW-2 ☐ S-1 10% CALC
☐ GW-3
☐ S-1 GW-1 ☐ S-1 GW-2 ☐ S-1 GW-3
☐ S-2 GW-1 ☐ S-2 GW-2 ☐ S-2 GW-3
☐ S-3 GW-1 ☐ S-3 GW-2 ☐ S-3 GW-3
☐ SW Protection

State where samples were collected: _____

Data Format
☐ Excel
☐ PDF
☐ GIS/Key
☐ EQuIS
☐ Other

Data Package
☐ Tier II Checklist
☐ Full Data Package*
☐ Phoenix Std Report
☐ Other
* SURCHARGE APPLIES

PEL-126 REV. 03/22

ALPHA ANALYTICAL

ANALYTICAL REPORT

Lab Number:	L2238593
Client:	Phoenix Environmental Labs 587 East Middle Turnpike P.O. Box 370 Manchester, CT 06040
ATTN:	Helen Geoghegan
Phone:	(860) 645-8726
Project Name:	GCL81090
Project Number:	Not Specified
Report Date:	07/26/22

Certifications & Approvals: MA (M-MA030), NH NELAP (2062), CT (PH-0141), DoD (L2474), FL (E87814), IL (200081), LA (85084), ME (MA00030), MD (350), NJ (MA015), NY (11627), NC (685), OH (CL106), PA (68-02089), RI (LAO00299), TX (T104704419), VT (VT-0015), VA (460194), WA (C954), US Army Corps of Engineers, USDA (Permit #P330-17-00150), USFWS (Permit #206964).

320 Forbes Boulevard, Mansfield, MA 02048-1806
508-822-9300 (Fax) 508-822-3288 800-624-9220 - www.alphalab.com

Project Name: GCL81090
Project Number: Not Specified

Lab Number: L2238593
Report Date: 07/26/22

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2238593-01	CL81090	DW	MA	07/19/22 09:01	07/20/22
L2238593-02	CL81091 FB	DW	MA	07/19/22 09:01	07/20/22

Project Name:	GCL81090	**Lab Number:**	L2238593
Project Number:	Not Specified	**Report Date:**	07/26/22

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name:	GCL81090	**Lab Number:**	L2238593
Project Number:	Not Specified	**Report Date:**	07/26/22

Case Narrative (continued)

Report Submission

All non-detect (ND) or estimated concentrations (J-qualified) have been quantitated to the limit noted in the MDL column.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Ashley Boucher Ashley Boucher

Title: Technical Director/Representative Date: 07/26/22

ORGANICS

SEMIVOLATILES

Project Name: GCL81090
Project Number: Not Specified

Lab Number: L2238593
Report Date: 07/26/22

SAMPLE RESULTS

Lab ID: L2238593-01
Client ID: CL81090
Sample Location: MA

Date Collected: 07/19/22 09:01
Date Received: 07/20/22
Field Prep: Not Specified

Sample Depth:
Matrix: Dw
Analytical Method: 133,537.1
Analytical Date: 07/25/22 13:22
Analyst: LV

Extraction Method: EPA 537.1
Extraction Date: 07/23/22 16:19

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab						
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	2.00	0.638	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	2.00	0.638	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND		ng/l	2.00	0.638	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	2.00	0.638	1
Perfluorohexanesulfonic Acid (PFHxS)	2.33		ng/l	2.00	0.638	1
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	0.638	1
Perfluorooctanoic Acid (PFOA)	0.993	J	ng/l	2.00	0.638	1
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	0.638	1
Perfluorooctanesulfonic Acid (PFOS)	3.97		ng/l	2.00	0.638	1
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	0.638	1
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	0.638	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	2.00	0.638	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	0.638	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	0.638	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	0.638	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	0.638	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	2.00	0.638	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	2.00	0.638	1
PFAS, Total (6)	6.30		ng/l	2.00	0.638	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	101		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	96		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	98		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	86		70-130

Project Name: GCL81090
Project Number: Not Specified

Lab Number: L2238593
Report Date: 07/26/22

SAMPLE RESULTS

Lab ID: L2238593-02
Client ID: CL81091 FB
Sample Location: MA

Date Collected: 07/19/22 09:01
Date Received: 07/20/22
Field Prep: Not Specified

Sample Depth:
Matrix: Dw
Analytical Method: 133,537.1
Analytical Date: 07/25/22 13:40
Analyst: LV

Extraction Method: EPA 537.1
Extraction Date: 07/23/22 16:19

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab						
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	2.00	0.622	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	2.00	0.622	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND		ng/l	2.00	0.622	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	2.00	0.622	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	2.00	0.622	1
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	0.622	1
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	0.622	1
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	0.622	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	0.622	1
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	0.622	1
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	0.622	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	2.00	0.622	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	0.622	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	0.622	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	0.622	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	0.622	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	2.00	0.622	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	2.00	0.622	1
PFAS, Total (6)	ND		ng/l	2.00	0.622	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	106		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	104		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	101		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	97		70-130

Project Name: GCL81090 **Lab Number:** L2238593

Project Number: Not Specified **Report Date:** 07/26/22

Method Blank Analysis
Batch Quality Control

Analytical Method: 133,537.1
Analytical Date: 07/25/22 10:17
Analyst: LV

Extraction Method: EPA 537.1
Extraction Date: 07/23/22 16:19

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab for sample(s): 01-02 Batch: WG1666562-1					
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	2.00	0.668
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	2.00	0.668
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND		ng/l	2.00	0.668
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	2.00	0.668
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	2.00	0.668
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	0.668
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	0.668
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	0.668
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	0.668
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	0.668
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	0.668
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	2.00	0.668
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	0.668
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	0.668
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	0.668
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	0.668
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	2.00	0.668
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	2.00	0.668
PFAS, Total (6)	ND		ng/l	2.00	0.668

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	99		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	97		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	98		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	96		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: GCL81090
Project Number: Not Specified

Lab Number: L2238593
Report Date: 07/26/22

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 Batch: WG1666562-2								
Perfluorobutanesulfonic Acid (PFBS)	86		-		50-150	-		30
Perfluorohexanoic Acid (PFHxA)	106		-		50-150	-		30
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	110		-		50-150	-		30
Perfluoroheptanoic Acid (PFHpA)	108		-		50-150	-		30
Perfluorohexanesulfonic Acid (PFHxS)	90		-		50-150	-		30
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	112		-		50-150	-		30
Perfluorooctanoic Acid (PFOA)	112		-		50-150	-		30
Perfluorononanoic Acid (PFNA)	126		-		50-150	-		30
Perfluorooctanesulfonic Acid (PFOS)	99		-		50-150	-		30
Perfluorodecanoic Acid (PFDA)	124		-		50-150	-		30
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	75		-		50-150	-		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	110		-		50-150	-		30
Perfluoroundecanoic Acid (PFUnA)	130		-		50-150	-		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	116		-		50-150	-		30
Perfluorododecanoic Acid (PFDoA)	118		-		50-150	-		30
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	87		-		50-150	-		30
Perfluorotridecanoic Acid (PFTrDA)	126		-		50-150	-		30
Perfluorotetradecanoic Acid (PFTA)	112		-		50-150	-		30

Lab Control Sample Analysis
Batch Quality Control

Project Name: GCL81090
Project Number: Not Specified

Lab Number: L2238593
Report Date: 07/26/22

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 Batch: WG1666562-2								

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	102				70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	99				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	102				70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	100				70-130

Matrix Spike Analysis
Batch Quality Control

Project Name: GCL81090
Project Number: Not Specified

Lab Number: L2238593
Report Date: 07/26/22

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 QC Batch ID: WG1666562-3 QC Sample: L2238533-01 Client ID: MS Sample												
Perfluorobutanesulfonic Acid (PFBS)	0.601J	1.63	1.95J	120		-	-		50-150	-		30
Perfluorohexanoic Acid (PFHxA)	2.69	1.84	4.26	85		-	-		50-150	-		30
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid (HFPO-DA)	ND	1.84	1.76J	96		-	-		50-150	-		30
Perfluoroheptanoic Acid (PFHpA)	ND	1.84	2.10	114		-	-		50-150	-		30
Perfluorohexanesulfonic Acid (PFHxS)	0.707J	1.68	2.13	127		-	-		50-150	-		30
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND	1.74	1.62J	93		-	-		50-150	-		30
Perfluorooctanoic Acid (PFOA)	ND	1.84	2.06	112		-	-		50-150	-		30
Perfluorononanoic Acid (PFNA)	ND	1.84	2.21	120		-	-		50-150	-		30
Perfluorooctanesulfonic Acid (PFOS)	ND	1.71	1.91J	112		-	-		50-150	-		30
Perfluorodecanoic Acid (PFDA)	ND	1.84	2.06	112		-	-		50-150	-		30
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND	1.71	1.32J	77		-	-		50-150	-		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND	1.84	1.65J	90		-	-		50-150	-		30
Perfluoroundecanoic Acid (PFUnA)	ND	1.84	2.17	118		-	-		50-150	-		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND	1.84	1.88J	102		-	-		50-150	-		30
Perfluorododecanoic Acid (PFDoA)	ND	1.84	1.95J	106		-	-		50-150	-		30
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND	1.73	1.58J	91		-	-		50-150	-		30
Perfluorotridecanoic Acid (PFTrDA)	ND	1.84	2.21	120		-	-		50-150	-		30
Perfluorotetradecanoic Acid (PFTA)	ND	1.84	1.95J	106		-	-		50-150	-		30

Matrix Spike Analysis
Batch Quality Control

Project Name: GCL81090
Project Number: Not Specified

Lab Number: L2238593
Report Date: 07/26/22

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 QC Batch ID: WG1666562-3 QC Sample: L2238533-01 Client ID: MS Sample												

Surrogate	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-13C3-Propanoic Acid (M3HFPO-DA)	90				70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	93				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	84				70-130
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	92				70-130

Lab Duplicate Analysis
Batch Quality Control

Project Name: GCL81090
Project Number: Not Specified

Lab Number: L2238593
Report Date: 07/26/22

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 QC Batch ID: WG1666562-4 QC Sample: L2238533-02 Client ID: DUP Sample						
Perfluorobutanesulfonic Acid (PFBS)	ND	ND	ng/l	NC		30
Perfluorohexanoic Acid (PFHxA)	ND	ND	ng/l	NC		30
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid (HFPO-DA)	ND	ND	ng/l	NC		30
Perfluoroheptanoic Acid (PFHpA)	ND	ND	ng/l	NC		30
Perfluorohexanesulfonic Acid (PFHxS)	ND	ND	ng/l	NC		30
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND	ND	ng/l	NC		30
Perfluorooctanoic Acid (PFOA)	ND	ND	ng/l	NC		30
Perfluorononanoic Acid (PFNA)	ND	ND	ng/l	NC		30
Perfluorooctanesulfonic Acid (PFOS)	ND	ND	ng/l	NC		30
Perfluorodecanoic Acid (PFDA)	ND	ND	ng/l	NC		30
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND	ND	ng/l	NC		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND	ND	ng/l	NC		30
Perfluoroundecanoic Acid (PFUnA)	ND	ND	ng/l	NC		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND	ND	ng/l	NC		30
Perfluorododecanoic Acid (PFDoA)	ND	ND	ng/l	NC		30
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND	ND	ng/l	NC		30
Perfluorotridecanoic Acid (PFTrDA)	ND	ND	ng/l	NC		30
Perfluorotetradecanoic Acid (PFTA)	ND	ND	ng/l	NC		30

Lab Duplicate Analysis
Batch Quality Control

Project Name: GCL81090
Project Number: Not Specified

Lab Number: L2238593
Report Date: 07/26/22

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits

Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-02 QC Batch ID: WG1666562-4 QC Sample: L2238533-02 Client ID: DUP Sample

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	97		95		70-130
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-13C3-Propanoic Acid (M3HFPO-DA)	92		91		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	95		92		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	96		94		70-130

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2238593-01A	Plastic 250ml Trizma preserved	A	NA		5.3	Y	Absent		A2-MA-537.1(14)
L2238593-01B	Plastic 250ml Trizma preserved	A	NA		5.3	Y	Absent		A2-MA-537.1(14)
L2238593-02A	Plastic 250ml Trizma preserved	A	NA		5.3	Y	Absent		A2-MA-537.1(14)

*Values in parentheses indicate holding time in days

Project Name: GCL81090
Project Number:

Lab Number: L2238593
Report Date: 07/26/22

PFAS PARAMETER SUMMARY

Parameter	Acronym	CAS Number
PERFLUOROALKYL CARBOXYLIC ACIDS (PFCAs)		
Perfluorooctadecanoic Acid	PFODA	16517-11-6
Perfluorohexadecanoic Acid	PFHxDA	67905-19-5
Perfluorotetradecanoic Acid	PFTA	376-06-7
Perfluorotridecanoic Acid	PFTrDA	72629-94-8
Perfluorododecanoic Acid	PFDoA	307-55-1
Perfluoroundecanoic Acid	PFUnA	2058-94-8
Perfluorodecanoic Acid	PFDA	335-76-2
Perfluorononanoic Acid	PFNA	375-95-1
Perfluorooctanoic Acid	PFOA	335-67-1
Perfluoroheptanoic Acid	PFHpA	375-85-9
Perfluorohexanoic Acid	PFHxA	307-24-4
Perfluoropentanoic Acid	PFPeA	2706-90-3
Perfluorobutanoic Acid	PFBA	375-22-4
PERFLUOROALKYL SULFONIC ACIDS (PFSAs)		
Perfluorododecanesulfonic Acid	PFDoDS	79780-39-5
Perfluorodecanesulfonic Acid	PFDS	335-77-3
Perfluorononanesulfonic Acid	PFNS	68259-12-1
Perfluorooctanesulfonic Acid	PFOS	1763-23-1
Perfluoroheptanesulfonic Acid	PFHpS	375-92-8
Perfluorohexanesulfonic Acid	PFHxS	355-46-4
Perfluoropentanesulfonic Acid	PFPeS	2706-91-4
Perfluorobutanesulfonic Acid	PFBS	375-73-5
FLUOROTELOMERS		
1H,1H,2H,2H-Perfluorododecanesulfonic Acid	10:2FTS	120226-60-0
1H,1H,2H,2H-Perfluorodecanesulfonic Acid	8:2FTS	39108-34-4
1H,1H,2H,2H-Perfluorooctanesulfonic Acid	6:2FTS	27619-97-2
1H,1H,2H,2H-Perfluorohexanesulfonic Acid	4:2FTS	757124-72-4
PERFLUOROALKANE SULFONAMIDES (FASAs)		
Perfluorooctanesulfonamide	FOSA	754-91-6
N-Ethyl Perfluorooctane Sulfonamide	NEtFOSA	4151-50-2
N-Methyl Perfluorooctane Sulfonamide	NMeFOSA	31506-32-8
PERFLUOROALKANE SULFONYL SUBSTANCES		
N-Ethyl Perfluorooctanesulfonamido Ethanol	NEtFOSE	1691-99-2
N-Methyl Perfluorooctanesulfonamido Ethanol	NMeFOSE	24448-09-7
N-Ethyl Perfluorooctanesulfonamidoacetic Acid	NEtFOSAA	2991-50-6
N-Methyl Perfluorooctanesulfonamidoacetic Acid	NMeFOSAA	2355-31-9
PER- and POLYFLUOROALKYL ETHER CARBOXYLIC ACIDS		
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid	HFPO-DA	13252-13-6
4,8-Dioxa-3h-Perfluorononanoic Acid	ADONA	919005-14-4
CHLORO-PERFLUOROALKYL SULFONIC ACIDS		
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1
PERFLUOROETHER SULFONIC ACIDS (PFESAs)		
Perfluoro(2-Ethoxyethane)Sulfonic Acid	PFEESA	113507-82-7
PERFLUOROETHER/POLYETHER CARBOXYLIC ACIDS (PFPCAs)		
Perfluoro-3-Methoxypropanoic Acid	PFMPA	377-73-1
Perfluoro-4-Methoxybutanoic Acid	PFMBA	863090-89-5
Nonafluoro-3,6-Dioxaheptanoic Acid	NFDHA	151772-58-6

Project Name: GCL81090 **Lab Number:** L2238593

Project Number: Not Specified **Report Date:** 07/26/22

GLOSSARY

Acronyms

DL - Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

EDL - Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).

EMPC - Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.

EPA - Environmental Protection Agency.

LCS - Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LCSD - Laboratory Control Sample Duplicate: Refer to LCS.

LFB - Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LOD - Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

LOQ - Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

MDL - Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

MS - Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.

MSD - Matrix Spike Sample Duplicate: Refer to MS.

NA - Not Applicable.

NC - Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.

NDPA/DPA - N-Nitrosodiphenylamine/Diphenylamine.

NI - Not Ignitable.

NP - Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.

NR - No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.

RL - Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

RPD - Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.

SRM - Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.

STLP - Semi-dynamic Tank Leaching Procedure per EPA Method 1315.

TEF - Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.

TEQ - Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.

TIC - Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Report Format: DU Report with 'J' Qualifiers

Project Name:	GCL81090	**Lab Number:**	L2238593
Project Number:	Not Specified	**Report Date:**	07/26/22

Footnotes

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Chlordane: The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Gasoline Range Organics (GRO): Gasoline Range Organics (GRO) results include all chromatographic peaks eluting from Methyl tert butyl ether through Naphthalene, with the exception of GRO analysis in support of State of Ohio programs, which includes all chromatographic peaks eluting from Hexane through Dodecane.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW compliance analysis only, the 'PFAS, Total (6)' result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. The Target analyte concentration is below the quantitation limit (RL), but above the Method Detection Limit (MDL) or Estimated Detection Limit (EDL) for SPME-related analyses. This represents an estimated concentration for Tentatively

Report Format: DU Report with 'J' Qualifiers

Project Name:	GCL81090	**Lab Number:**	L2238593
Project Number:	Not Specified	**Report Date:**	07/26/22

Data Qualifiers

Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

ND - Not detected at the method detection limit (MDL) for the sample, or estimated detection limit (EDL) for SPME-related analyses.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

V - The surrogate associated with this target analyte has a recovery outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Z - The batch matrix spike and/or duplicate associated with this target analyte has a recovery/RPD outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Report Format: DU Report with 'J' Qualifiers

Project Name:	GCL81090	**Lab Number:**	L2238593
Project Number:	Not Specified	**Report Date:**	07/26/22

REFERENCES

133 Determination of Selected Per- and Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). EPA Method 537.1, EPA/600/R-18/352. Version 1.0, November 2018.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624/624.1: m/p-xylene, o-xylene, Naphthalene
EPA 625/625.1: alpha-Terpineol
EPA 8260C/8260D: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene, 4-Ethyltoluene,
EPA 8270D/8270E: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine, alpha-Terpineol; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility
SM 2540D: TSS
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2:** Nitrate-N, Nitrite-N; **SM4500NO3-F:** Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D.**

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1:** Ammonia-N, **LACHAT 10-107-06-1-B:** Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2:** Nitrate-N, **SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045:** PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603, SM9222D.**

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522, EPA 537.1.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb, As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

L2238593

Serial_No:07262215:04

Cooler: Yes ☐ No ☐ Coolant: IPK ☐ ICE ☐ No ☐

Temp °C Pg of

CHAIN OF CUSTODY RECORD

Page 1 of 1

PHOENIX Environmental Laboratories, Inc.

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email: info@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-8726

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Customer: Alpha Analytical
Address: 8 Walkup Dr
Westborough, MA
(508) 898-9220

Project #: GCL81090
Report to: HelenG@PhoenixLabs.com / Helen Geoghegan
Invoice to: AccountsPayable@PhoenixLabs.com
Quote# :

Project P.O: GCL81090

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature _____ Date: _____

Matrix Code:
DW=Drinking Water GW=Ground Water SW=Surface Water WW=Waste Water
RW=Raw Water SE=Sediment SL=Sludge S=Soil SO=Solid W=Wipe
OIL=Oil B=Bulk L=Liquid

Analysis Request

Phoenix Sample ID	Sample Comment	Sample Matrix	Date Sampled	Time Sampled	PFAS (18) E537.1	250ml HDPE Plastic w/Trizma
CL81090		DW	7/19/2022	9:01 AM	x	2
CL81091	FB	DW	7/19/2022	9:01 AM	x	2

Relinquished by:	Accepted by:	Date:	Time:
		7.20.22	11
		7/20/22	11:-
		7/20/22	

Comments, Special Requirements or Regulations:
Rel by [illegible] 7/20-22 21:30

Please send notice as soon as possible not exceeding 24 hours of obtaining valid data, of the results of all drinking water samples that exceed any EPA or Department-established maximum contaminant level, maximum residual disinfectant level or reportable concentration.

Please notify Phoenix Environmental Laboratories, Inc. immediately and prior to conducting analysis if certification is not held for the analyses requested.

Turnaround:
☐ 1 Day
☐ 2 Days
☐ 3 Days
☐ 5 Days
☐ 10 Days
☒ Standard
☐ Other_____

Report Type:
☒ Standard PDF
☐ Full Data Package
☐ NJ Reduced Deliverable
☐ NJ Full Deliverable
☐ NY ASP B

EDD Format:
☐ Excel
☐ GIS/Key
☐ EQuIS
☐ NJ Hazsite EDD
☐ NY EZ EDD (ASP)
☐ Other_____

State Criteria:
MA DW

What State were samples collected?
MA

EXHIBIT # 2

UNDERWATER SOLUTIONS INC

SERVICES COMPLETED:	Inspection and Cleaning
CUSTOMER NAME:	Ware Department of Public Works
ADDRESS:	4 1/2 Church Street Ware, MA 01082
TANK NAME:	Anderson Road
SIZE:	1-Million-Gallon
TYPE OF TANK:	Steel Water Storage Tank
DIMENSIONS:	60'H x 60'D

UNDERWATER SOLUTIONS INC

INSPECTION AND INTERIOR CLEANING (SEDIMENT REMOVAL) OF THE ANDERSON ROAD 1-MILLION-GALLON WELDED STEEL WATER STORAGE TANK

WARE DEPARTMENT OF PUBLIC WORKS WARE, MASSACHUSETTS

AUGUST 14, 2020

SCOPE:

On August 14, 2020, Underwater Solutions Inc. completed an inspection of the Anderson Road 1-million-gallon welded steel potable water storage tank to provide information regarding the overall condition and integrity of this structure and removed the sediment accumulation found on the floor.

EXTERIOR INSPECTION:

The entire exterior of this water storage tank was inspected, to include walls and coating, anchor bolts, concrete foundation, manways, ladder, overflow, roof, vent and hatch.

The exterior of this structure was found having similar conditions as were found during a previous inspection completed by Underwater Solutions Inc. on December 15, 2015.

Walls And Coating

The exterior steel wall panels and associated welds were inspected and appeared sound and remain free of obvious fatigue or failures at this time.

The protective coating applied to the exterior walls has become chalky due to weathering and remains having mostly good adhesion value, however several isolated areas of coating loss were observed and remain throughout the two lowest rows of wall panels on the northernmost side of the tank.

No obvious fatigue (pitting) of the steel was evident within these 1/4" to 1/2" diameter to 24" long by 3" wide areas of steel exposure, rather mild surface corrosion exists at this time.

Adhesion loss of the finish coating was observed throughout approximately 5% of the exterior walls, resulting in exposure of the primary coating. The primary coating within these areas of exposure appeared to have good adhesion value at this time.

A mild to moderate, non-uniform accumulation of mildew throughout the exterior walls has declined the overall aesthetics.

It is our recommendation to monitor the wall panels showing steel exposure through future scheduled inspections to ensure that fatigue of the steel does not occur.

Anchor Bolts

Thirty-six, 1-1/2" diameter anchor bolts extend up from the concrete foundation through support chairs welded to the lowest row of wall panels.

Each anchor bolt has one nut securely installed and appeared sound at this time.

The protective coating applied to this steel support hardware was found having mostly good adhesion value, however isolated areas of coating loss were observed on several of the anchor bolt nuts where they contact a steel washer above their associated chair.

No obvious fatigue or deterioration of this support hardware was evident within these areas of steel exposure, rather mild corrosion exists at this time.

It is our recommendation to monitor the support hardware showing steel exposure through future scheduled inspections to ensure that fatigue of the steel does not occur.

Concrete Foundation

The exposed surfaces of the 6" wide by 6" tall concrete foundation is not coated and were found having tight cracks throughout approximately 5% of these exposed surfaces. These cracks were sounded and appeared to be limited to the surface of the concrete and remain free of obvious voids or spall at this time.

The sealant applied throughout the circumference of the tank at the junction of where the foundation and tank base meet remains having good adhesion value, preventing moisture from accumulating beneath the tank.

Manways

Two, 24" inside diameter manways penetrate the lowest row of wall panels on the northernmost and southernmost sides of the tank, located approximately 17" above the tank base and are securely installed and free of obvious leakage.

The protective coating applied to each manway lid and trunk remains having good adhesion value at this time.

The protective coating applied to the securing nut and bolt for each manway shows mild corrosion, however this steel hardware remains sound at this time.

Ladder

A welded steel ladder extends from approximately 16' above the ground up to the roof dome and is supported to the wall of the tank with seven sets of welded standoffs. A fall prevention device is installed throughout the length of this ladder, providing safe access and egress to and from the roof.

A welded safety cage extends the top 6' of this ladder and is supported with three sets of welded standoffs.

The protective coating applied to the ladder, safety cage and fall prevention device was found having good adhesion value at this time.

Overflow

An 8" inside diameter overflow pipe exits the base of a welded steel weir box that is welded to the top wall panel. This pipe extends down, supported to the tank wall with seven welded standoffs, through a 90° elbow and terminates approximately 36" above a concrete splash pad.

This overflow pipe was free of obvious obstructions and was found with a flap-valve installed at its end, however the end of this pipe was found without a screen at this time.

It is our recommendation to install a non-corrodible metal, 24-mesh screen within the end of the pipe and behind the flap-valve in an effort to prevent access to the interior of the pipe/tank.

The inspection hatch, located on the top of the weir box was found secured with a series of nuts and bolts, preventing access to the interior of the tank.

The protective coating applied to this steel pipe and steel weir box was found having mostly good adhesion value, however several isolated areas of coating loss were observed throughout less than these surfaces, resulting in exposure of the underlying steel. No obvious fatigue of this steel pipe or weir box was evident within these isolated areas of steel exposure, rather mild surface corrosion exists at this time.

Roof

The steel roof panels, and associated welds were inspected and appeared sound and remain free of obvious fatigue or failures at this time.

The protective coating applied to these surfaces has become chalky due to weathering and remains having mostly good adhesion value at this time.

Several isolated areas of coating loss were observed throughout approximately 5% of these surfaces, resulting in exposure of the underlying steel.

No obvious fatigue of the steel panels or welds was evident within these isolated areas of steel exposure, rather mild corrosion exists at this time.

A set of stairs, safety railing and a fall prevention device extend from the edge of the roof dome on the southernmost side of the tank up to the vent, supported to the roof with seven welded standoffs. This stair assembly was found securely installed and remains in sound condition, providing safe access and egress to and from the vent/center of roof.

The protective coating applied to the welded steel safety railing and stair assembly was found having mostly good adhesion value at this time. Adhesion loss of the coating was observed through less than 5% of these surfaces, resulting in exposure of the underlying steel. No obvious fatigue of the steel was evident within these areas of exposure, rather mild corrosion exists at this time.

It is our recommendation to monitor the roof panels, welds and stair assembly surfaces showing steel exposure through future scheduled inspections to ensure that fatigue of the steel does not occur.

Each of the twenty-three, 5/8" diameter rigging hole penetrations within the roof dome remain sealed with threaded plugs, preventing access to the interior of the tank.

Vent

The steel vent assembly is located within the center of the roof dome, having a 10" inside diameter and stands 31" tall.

A 19" outside diameter steel cap and associated galvanized steel screen remain securely installed over this vent, however this vent does not have a cap that extends down to the base of the screen to prevent the access of wind driven rain and snow, while the current screen does not have 24-mesh.

The protective coating applied to the vent assembly was found having mostly good adhesion value, however isolated areas of coating loss was observed throughout less than 5% of these surfaces, resulting in exposure of the underlying steel. No obvious fatigue of the steel was evident within these areas of exposure, rather mild corrosion exists at this time.

It is our recommendation to remove the current screen from the vent and to install a replacement, non-corrodible metal screen having 24-mesh throughout the outside circumference of the vent in an effort to prevent access to the interior of the tank.

Hatch

Two, 24" inside diameter hatches provide access to the tank interior through the roof.

The hatch located at the edge of the roof dome on the southernmost side of the tank was opened and utilized to access the tank interior for this inspection. This hatch remains in good working condition and was found secured with a lock, preventing unwanted access to the interior of the tank.
The protective coating applied to the exterior of this hatch lid and trunk was found having mostly good adhesion value, however isolated areas of coating loss was observed throughout less than 5% of these surfaces, resulting in exposure of the underlying steel. No obvious fatigue of the steel was evident within these areas of exposure, rather mild corrosion exists at this time.

The protective coating applied to the interior of this hatch lid and trunk was found having mostly good adhesion value, however isolated areas of coating loss was observed throughout less than 5% of these surfaces, resulting in exposure of the underlying steel. No obvious fatigue of the steel was evident within these areas of exposure, rather mild corrosion exists at this time.

A second hatch is located within the center of the roof dome and was found secured with a series of nuts and bolts, preventing access. This hatch was not opened at the time of this inspection.

The protective coating applied to the exterior of this hatch lid and trunk was found having mostly good adhesion value, however isolated areas of coating loss was observed throughout less than 5% of these surfaces, resulting in exposure of the underlying steel. No obvious fatigue of the steel was evident within these areas of exposure, rather mild corrosion exists at this time.

Although this hatch was not opened, the interior of this hatch was observed from within the tank and the protective coating applied to the interior of this hatch lid and trunk was found having mostly good adhesion value, however isolated areas of coating loss was observed throughout less than 5% of these surfaces, resulting in exposure of the underlying steel. No obvious fatigue of the steel was evident within these areas of exposure, rather mild corrosion exists at this time.

EXTERIOR RECOMMENDATION(S): It is our recommendation to pressure-wash the exterior of the tank, including the components affixed to the exterior of the tank at 3,500 P.S.I. using a 40° tip and an environmentally approved cleaning agent to remove all soluble/insoluble surface contamination, chalk and mildew from the exterior surfaces of this tank, followed by a clean water rinse to remove all cleaning residue in an effort to preserve the adhesion value of the protective coating and improve the aesthetics.

It is also our recommendation to hand/power tool clean the surfaces of the tank showing coating fatigue to bare metal to achieve a uniform anchor profile and to re-coat these areas with a prime coat, intermediate coat and finish coat using protective coatings that are formulated for exterior exposure and to be applied in accordance with the product manufacturer's surface preparation and application recommendations in an effort to halt corrosion, prevent steel fatigue and to provide good protection for the steel.

We recommend that during the exterior rehabilitation of this tank to remove the existing vent assembly and to install a replacement non-corrodible metal AWWA compliant fail-safe (frost -proof) vent having a non-corrodible 24-mesh screen over the vent penetration in the roof to allow for proper ventilation and to prevent access to the interior of the tank.

It is our recommendation that after exterior pressure-washing is complete to hand/power tool clean the exposed surfaces of the foundation showing cracks to achieve a uniform anchor profile and to apply two coats of a masonry waterproofing coating to all cracks in an effort to seal the cracks and to prevent moisture penetration.

Prior to any re-habilitation it would be our recommendation to obtain a lead content sample of the protective coating applied to the exterior surfaces of the tank to determine the best course of rehabilitation.

INTERIOR INSPECTION:

The entire interior of this water storage tank was inspected, to include sediment accumulations, floor, manways, piping, walls and coating, overhead, overflow and aesthetic water quality.

Sediment Accumulations

A uniform layer of accumulated precipitate was found throughout the floor, ranging from 9" to 22" in depth.

After completing this inspection, all precipitate vacuumed from the floor.

Floor

After removing the accumulated precipitate, the floor panels and associated welds were inspected and appearing sound and remain free of obvious fatigue or failure at this time.

The protective coating on these steel panels and welds appeared to have been applied uniformly and remains having good adhesion value, providing adequate protection for these steel panels and welds.

Mild to moderate staining remains throughout the floor due to the accumulation of precipitate.

Manways

Two, 24" inside diameter manways penetrate the lowest row of wall panels on the northernmost and southernmost sides of the tank, located approximately 17" above the floor and are securely installed and free of obvious leakage.

The protective coating on each manway appeared to have been applied uniformly and was found having mostly good adhesion value, however isolated areas of adhesion loss (blistering) of the coating was observed throughout less than 5% of the surfaces of each manway lid, trunk and davit hinge.

Several of these coating blisters have ruptured, resulting in exposure of the underlying steel. Corrosion was evident within these areas of exposure and fatigue (pitting) of the steel having depths of barely detectable levels was observed within the areas of steel exposure found throughout the surfaces of each manway lid at this time.

It is our recommendation to monitor the areas of steel fatigue (pitting) found throughout the surfaces of each manway lid through future scheduled inspections to ensure that the depth of fatigue (pitting) does not increase in depth and result in the potential for leakage.

Piping

The influent/effluent pipe penetrates the tank floor approximately 12" in from the wall on the easternmost side of the tank, having a 10" inside diameter and is flush with the floor. A 6" tall by 10" inside diameter removable riser is installed above this pipe, serving as a silt stop.

This pipe was free of obvious obstructions at the time of this inspection.

The protective coating applied to the removable riser and exposed surfaces of the pipe penetration in the floor was found to be blistering throughout approximately 90% of all surfaces. Approximately 25% of these coating blisters have ruptured, resulting in exposure of the underlying steel. No obvious fatigue of the steel was evident within these areas of exposure, rather mild to moderate corrosion exists at this time.

It is our recommendation to monitor the surfaces of the removable riser and exposed interior surfaces of the pipe penetration in the floor through future scheduled inspections to ensure that fatigue of the steel does not occur.

Walls And Coating

The interior walls were inspected beginning at the floor and by spiraling the circumference of the tank up to the surface.

These steel wall panels and associated welds appeared sound at this time.

The protective coating on these steel panels and welds appeared to have been applied uniformly and was found having poor adhesion value at this time. Adhesion loss (blistering) of the coating was observed throughout approximately 10% of the wall panels and welds was observed throughout the lowest seven rows of wall panels. Less than 5% of these coating blisters have ruptured, resulting in exposure of the underlying steel. Corrosion exists within each area of steel exposure, while fatigue (pitting) of the steel having depths ranging from barely detectable levels to 1/8" in depth was observed within less than 5% of the areas of steel exposure at this time.

The protective coating applied to the top (eighth) row of wall panels was found having mostly good adhesion value, however adhesion loss of the protective coating was observed throughout approximately 35-40% of the circumference of the tank at the junction of where the roof and walls meet, resulting in exposure of the underlying steel.

No obvious fatigue of the steel wall panels, overhead panels or the weld at this junction was evident, rather mild corrosion and corrosion staining exists at this time.

Heavy staining exists on all wall surfaces, beginning at overflow level and extends down to the floor.

It is our recommendation to monitor the wall surfaces showing fatigue (pitting) of the steel through future scheduled inspections to ensure that the depth of fatigue (pitting) does not increase and result in the potential for leakage.

Overhead

The entire overhead was inspected from the water surface.

These steel panels, welds and channel iron supports appeared sound and remain free of obvious fatigue or failures at this time.

The protective coating applied to the steel overhead panels appeared to have mostly good adhesion value at this time. Decline (thinning) of the coating film thickness has resulted in corrosion bleed-through to show through the coating throughout approximately 15% of the channel iron supports, weld and panel edge surfaces, however the steel surfaces showing corrosion bleed-through, appeared sound and free of obvious fatigue at this time.

Adhesion loss of the protective coating was observed throughout approximately 25% of the circumference of the tank at the junction of where the roof and walls meet, resulting in exposure of the underlying steel.

No obvious fatigue of the steel wall panels, overhead panels or the weld at this junction was evident, rather mild corrosion and corrosion staining exists at this time.

It is our recommendation to monitor the edges of the overhead panels, angle iron supports and welds showing corrosion bleed-through through future scheduled inspection to ensure that fatigue of the steel does not occur.

It is also our recommendation to monitor the steel panels and weld at the junction of where the roof and walls meet through future scheduled inspections to ensure that fatigue of the steel panels or weld does not occur.

The vent penetration within the center of the overhead was free of obvious obstructions at the time of this inspection.

Overflow

The overflow consists of a 15" long by 5" wide cutout within the top wall panel, located approximately 6" below the junction of where the roof and walls meet.

This overflow cutout was free of obvious obstructions at the time of this inspection.

Aesthetic Water Quality

The aesthetic water quality within this tank was found to be good, allowing unlimited visibility for this inspection.

INTERIOR RECOMMENDATION(S): It is our recommendation to abrasive blast all interior floor, wall, overhead and interior component surfaces to white or near white metal to achieve a uniform anchor profile.

We recommend then re-surfacing all areas of steel fatigue (pitting) found throughout the interior walls using 100% solids surfacing epoxy and to re-coat these surfaces with a prime coat, intermediate coat and finish coat in an effort to halt corrosion and provide good protection for the steel.

We recommend that the products used to complete the interior rehabilitation be formulated for immersion wet contact, have an A.N.S.I./N.S.F. 61 approval for use in structures containing potable water and to be applied in accordance with the product manufacturer's surface preparation and application recommendations.

Prior to any re-habilitation it would be our recommendation to obtain a lead content sample of the protective coating applied to the interior surfaces of the tank to determine the best course of rehabilitation.

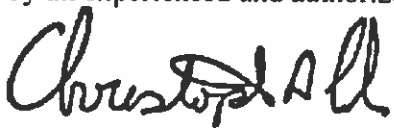
ADDITIONAL REMARKS/RECOMMENDATION(S):

It is our recommendation to install an N.S.F. approved active mixer within this structure to prevent ice cap formation and to improve overall water quality.

CONCLUSION:

It is the opinion of Underwater Solutions Inc. that welded steel potable water storage tank appeared mostly sound and remains free of obvious leakage at this time.

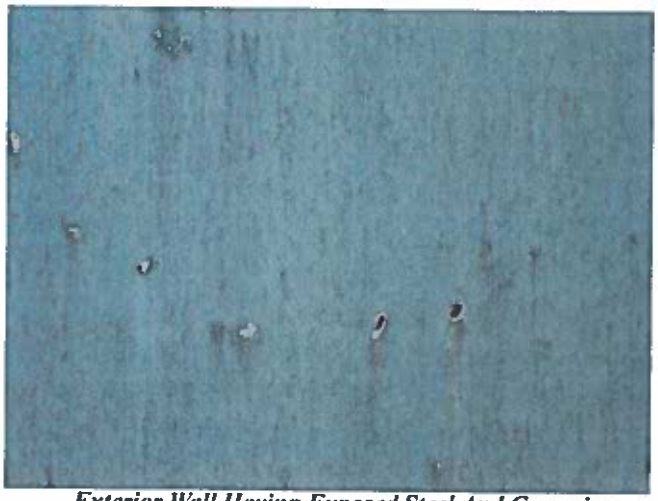
As always, we recommend that re-inspection and cleaning of all water storage facilities be performed in accordance with state and federal mandates, A.W.W.A. standards, and completed by an experienced and authorized inspection corporation.



UNDERWATER SOLUTIONS INC.

Christopher A. Cole, Project Manager

This report, the conclusions, recommendations and comments prepared by Underwater Solutions Inc. are based upon spot examination from readily accessible parts of the tank. Should latent defects or conditions which vary significantly from those described in the report be discovered at a later date, these should be brought to the attention of a qualified individual at that time. These comments and recommendations should be viewed as information to be used by the Owner in determining the proper course of action and not to replace a complete set of specifications. All repairs should be done in accordance with A.W.W.A. and/or other applicable standards.



1 *Exterior Wall Having Exposed Steel And Corrosion*

2 *Exterior Wall Having Exposed Steel And Corrosion*

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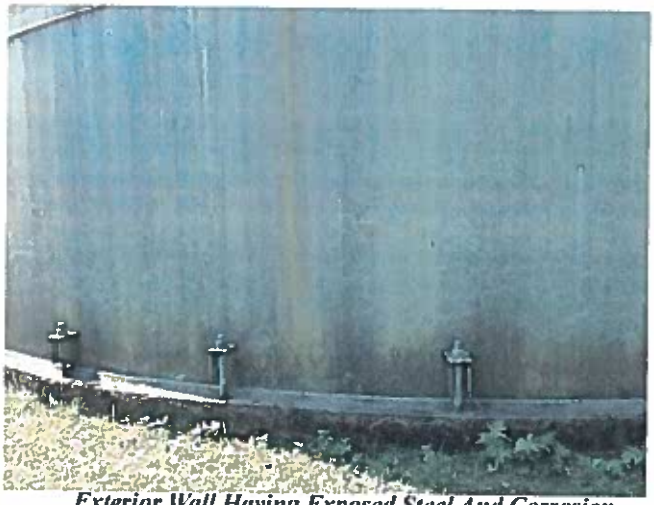


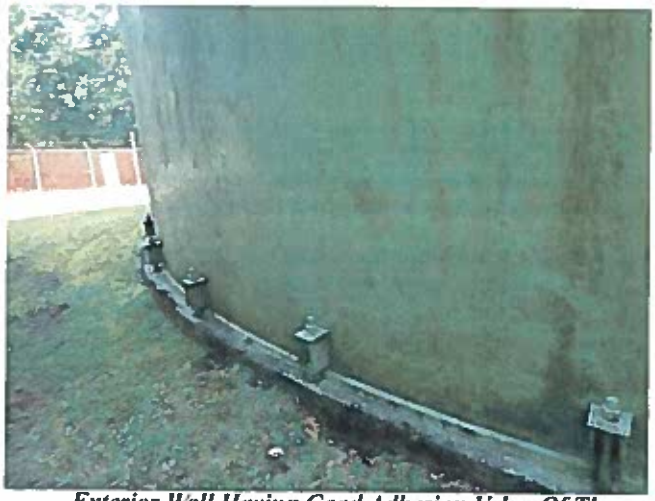
4 *Exterior Wall Having Exposed Steel And Corrosion*

5 *Exterior Wall Having Exposed Steel And Corrosion*

6 *Exterior Wall Having Exposed Primary Coating*

7 *Exterior Wall Having Good Adhesion Value Of The Protective Coating And A Mild To Moderate Non-Uniform Accumulation Of Mildew*

8 *Exterior Wall Having Good Adhesion Value Of The Protective Coating And A Mild To Moderate Non-Uniform Accumulation Of Mildew*



9 *Exterior Wall Having Good Adhesion Value Of The Protective Coating And A Mild To Moderate Non-Uniform Accumulation Of Mildew*

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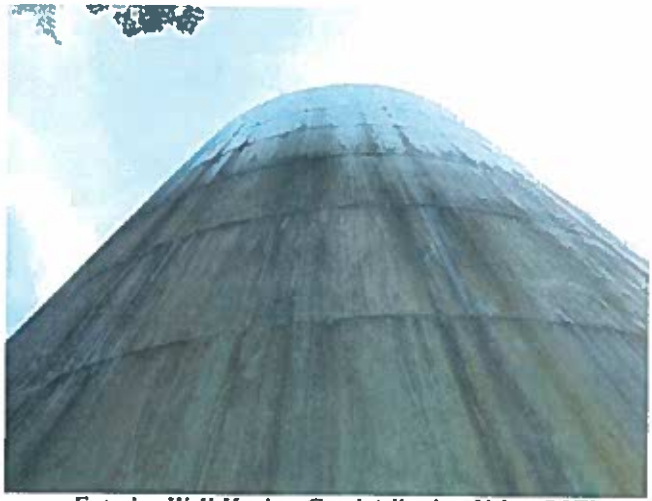
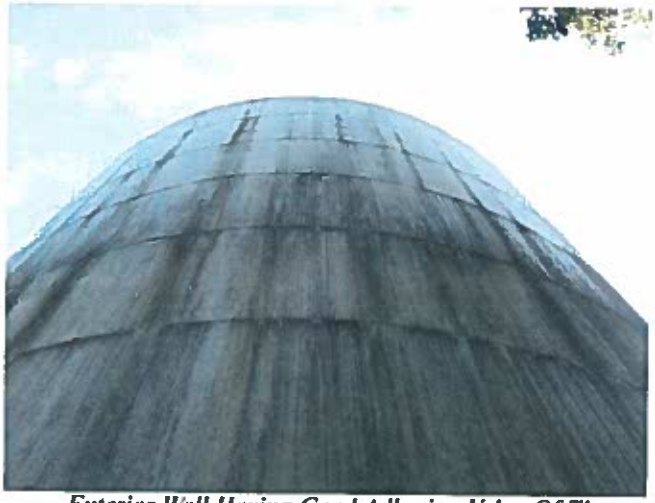
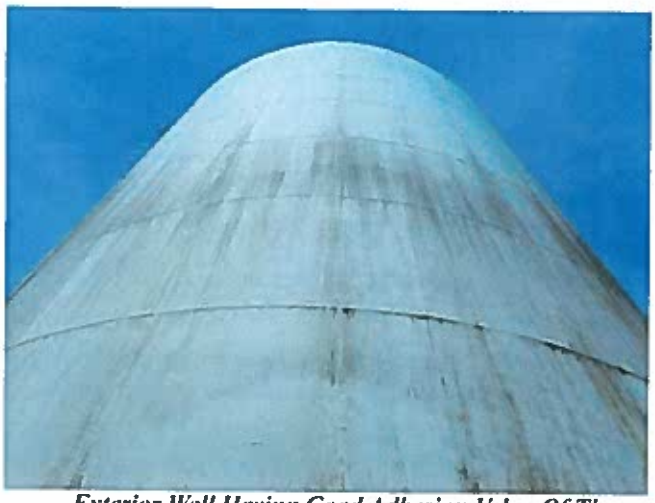


11 *Exterior Wall Having Good Adhesion Value Of The Protective Coating And A Mild To Moderate Non-Uniform Accumulation Of Mildew*



12 *Exterior Wall Having Good Adhesion Value Of The Protective Coating And A Mild To Moderate Non-Uniform Accumulation Of Mildew*



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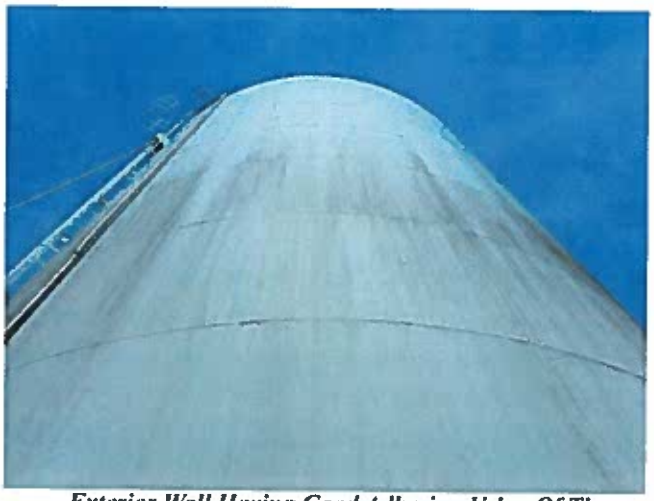


14 *Exterior Wall Having Good Adhesion Value Of The Protective Coating And A Mild To Moderate Non-Uniform Accumulation Of Mildew*

15 *Anchor Bolt Assembly Having Exposed Steel And Corrosion*

16 *Anchor Bolt Assembly Having Exposed Steel And Corrosion*

17 *Anchor Bolts Having Good Adhesion Value Of The Protective Coating*

18 *Foundation Appearing Sound*

19 *Manway Lid And Trunk Having Good Adhesion Value Of The Coating*

20 *Manway Securing Nut And Bolt Having Corrosion*

21 *Manway Lid And Trunk Having Good Adhesion Value Of The Coating*

22 *Manway Securing Nut And Bolt Having Corrosion*

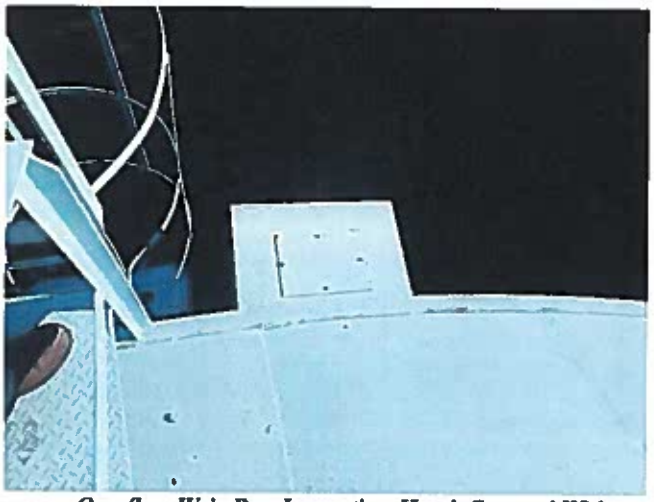
23 *Ladder, Safety Cage And Fall Prevention Device*

24 *Overflow Weir Box And Overflow Pipe*

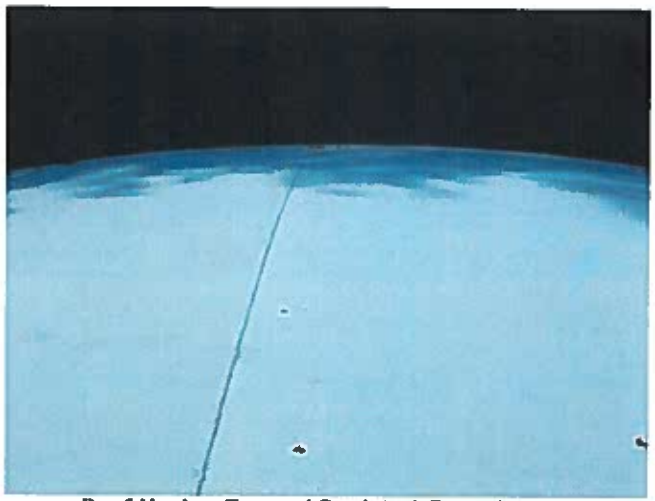
25 *Overflow Pipe Having A Flap Valve*

26 *Unobstructed Overflow Pipe*

27 *Overflow Pipe Having Exposed Steel And Corrosion*



28 *Overflow Weir Box Inspection Hatch Secured With Nuts And Bolts*

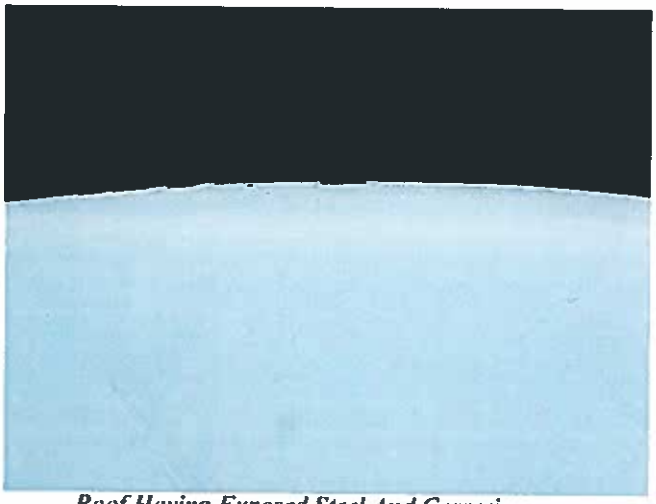


29 *Roof Having Exposed Steel And Corrosion*

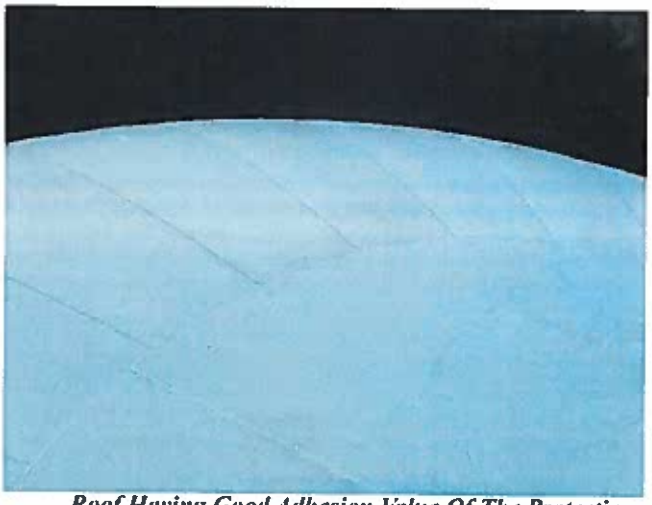
30 *Roof Having Exposed Steel And Corrosion*

31 *Roof Having Exposed Steel And Corrosion*

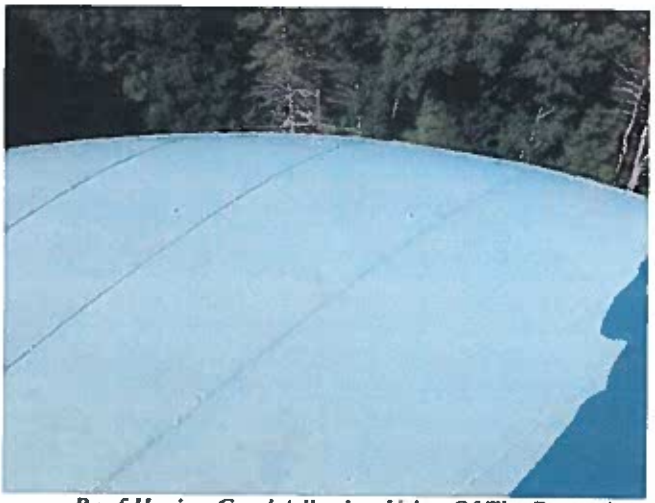
32 *Roof Having Exposed Steel And Corrosion*



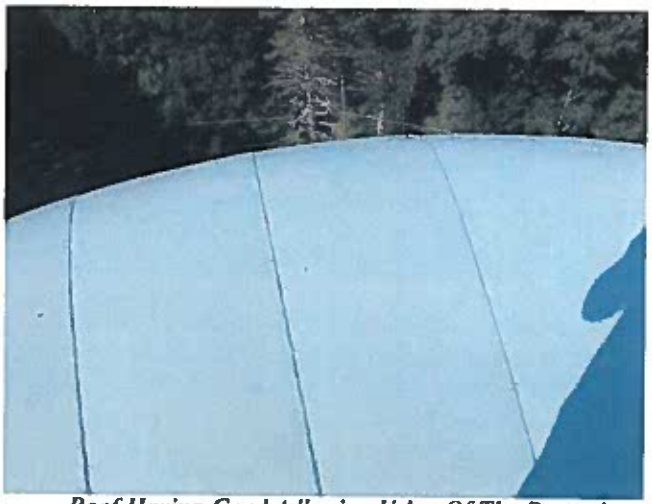
33 *Roof Having Exposed Steel And Corrosion*



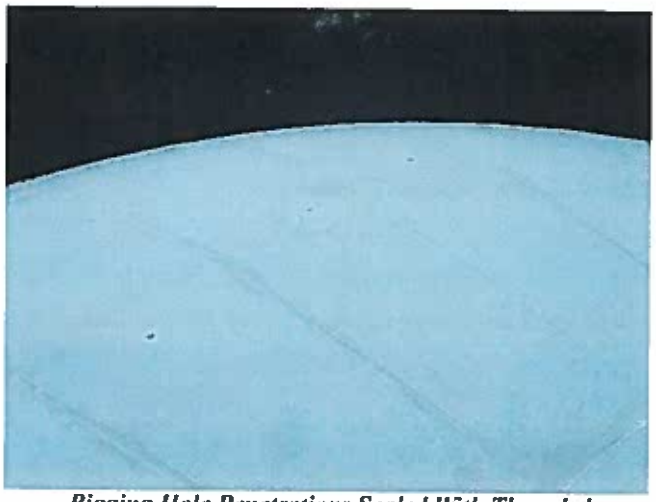
34 *Roof Having Good Adhesion Value Of The Protective Coating*



35 *Roof Having Good Adhesion Value Of The Protective Coating*



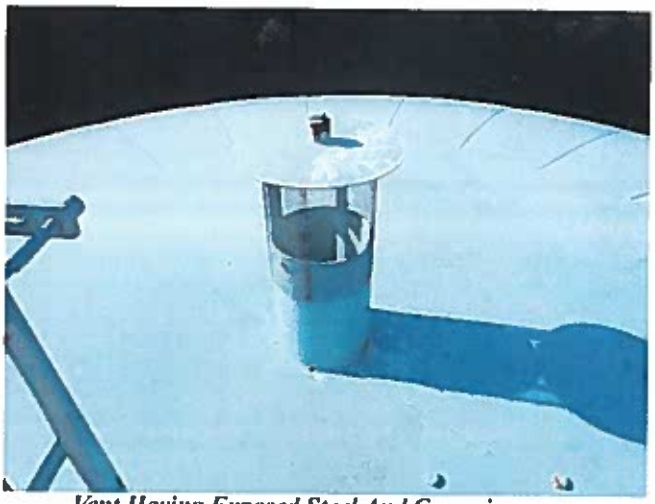
36 *Roof Having Good Adhesion Value Of The Protective Coating*



37 *Rigging Hole Penetrations Sealed With Threaded Plugs*

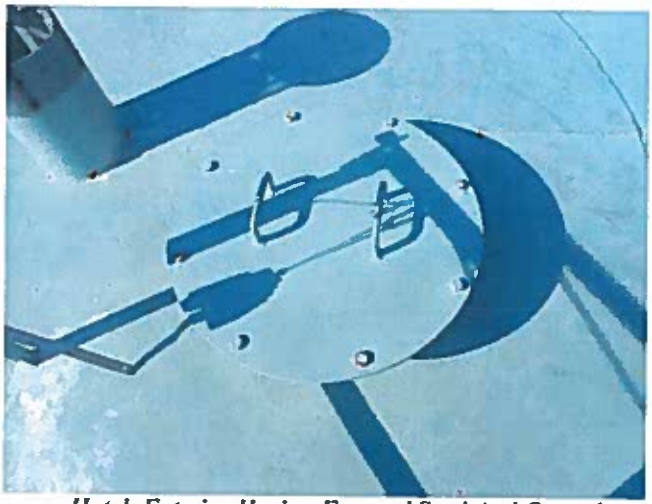
38 *Stairs And Safety Railings Having Coating Loss, Exposed Steel And Corrosion*

39 *Stairs And Safety Railings Having Coating Loss, Exposed Steel And Corrosion*



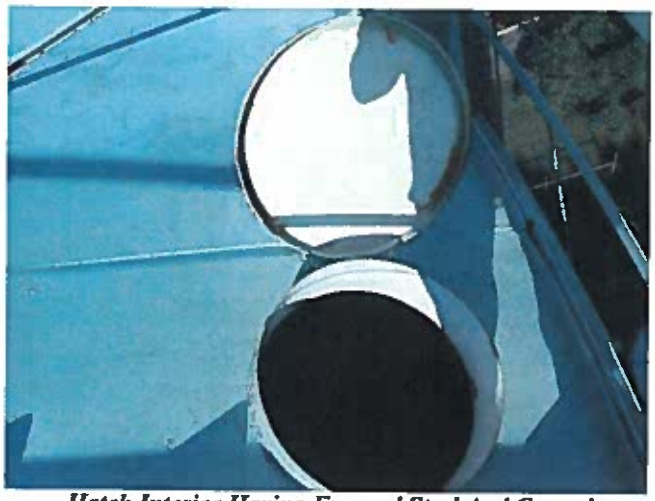
40 *Vent Having Exposed Steel And Corrosion*

41 *Secure Vent Screen*



42 *Hatch Exterior Having Exposed Steel And Corrosion*

43 *Hatch Interior Having Exposed Steel And Corrosion*



44 *Hatch Interior Having Exposed Steel And Corrosion*

45 *Hatch Closed And Secured With A Lock*

46 *Layer Of Precipitate*

47 *Layer Of Precipitate*

48 *Floor Having Good Adhesion Value Of The Coating And A Mild To Moderate Stain*

49 *Floor Having Good Adhesion Value Of The Coating And A Mild To Moderate Stain*

50 *Floor Having Good Adhesion Value Of The Coating And A Mild To Moderate Stain*

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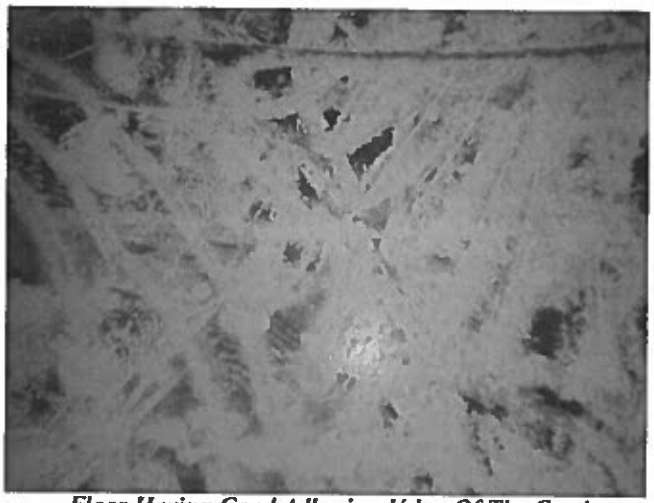

52 *Floor Having Good Adhesion Value Of The Coating And A Mild To Moderate Stain*

53 *Floor Having Good Adhesion Value Of The Coating And A Mild To Moderate Stain*

54 *Manway Having Exposed Steel And Corrosion*

55 *Manway Having Exposed Steel And Corrosion*

56 *Unobstructed Influent./Effluent Pipe*

57 *Removable Riser And Exposed Pipe Surfaces Having Exposed Steel And Corrosion*

58 *Interior Wall Having Coating Loss, Exposed Steel And Corrosion*

59 *Interior Wall Having Coating Loss, Exposed Steel And Corrosion*

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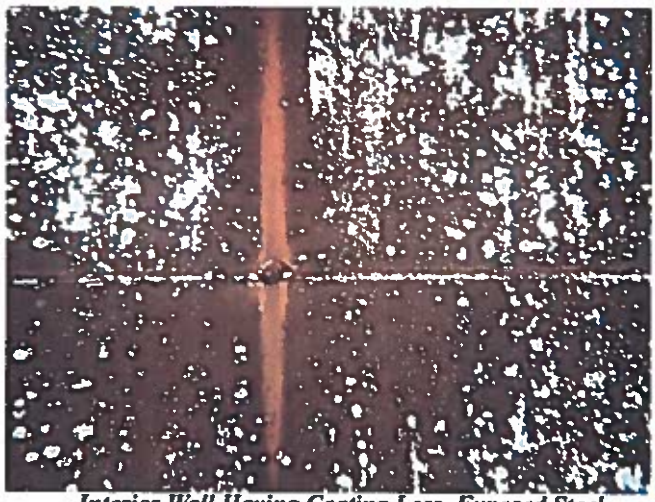
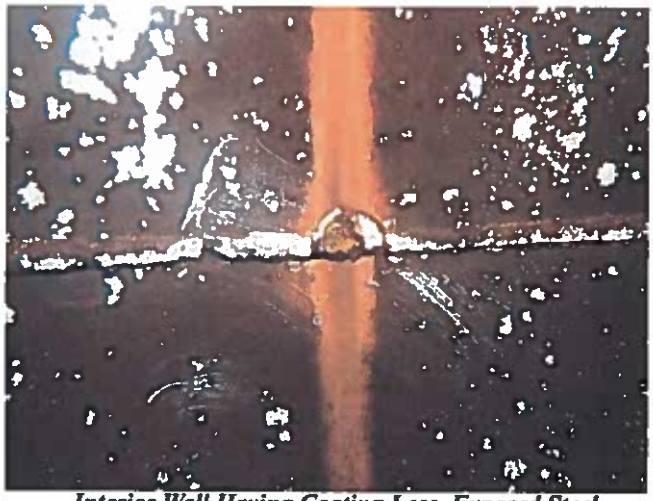
61 *Interior Wall Having Coating Loss, Exposed Steel And Corrosion*

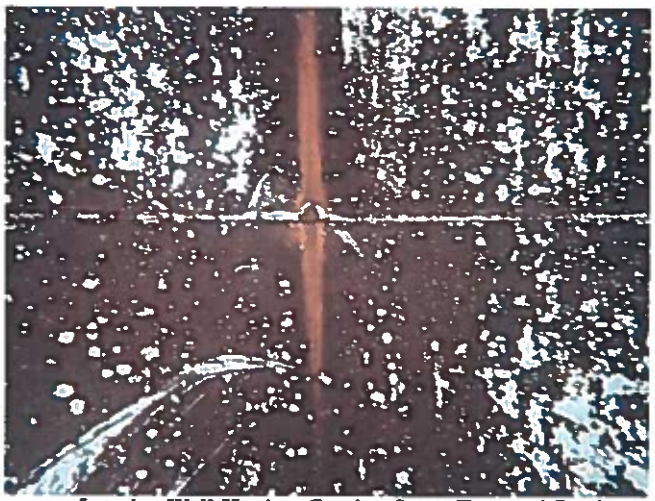
62 *Interior Wall Having Coating Loss, Exposed Steel And Corrosion*



63 *Interior Wall Having Coating Loss, Exposed Steel And Corrosion*



64 *Interior Wall Having Coating Loss, Exposed Steel And Corrosion*



65 *Interior Wall Having Coating Loss, Exposed Steel And Corrosion*

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67 *Interior Wall Having Coating Loss, Exposed Steel And Corrosion*

68 *Interior Wall Having Coating Loss, Exposed Steel And Corrosion*

69 *Interior Wall Panel Having Fatigue (Pitting) Of The Steel*

70 *Top Of The Top Row Of Wall Panels At The Junction Of Where The Walls And Roof Meet Having Exposed Steel And Corrosion*

71 *Top Of The Top Row Of Wall Panels At The Junction Of Where The Walls And Roof Meet Having Exposed Steel And Corrosion*

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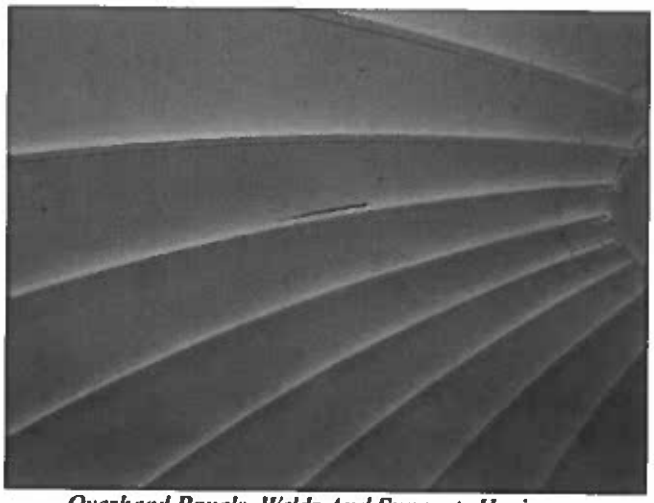
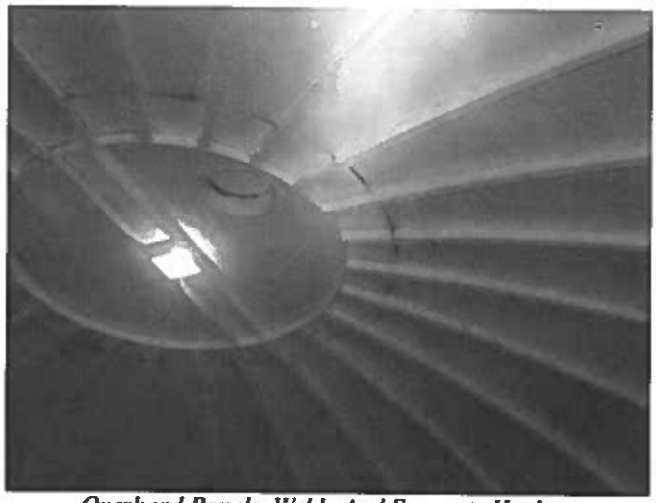


74 *Overhead Panels, Welds And Supports Having Corrosion Bleed-Through*



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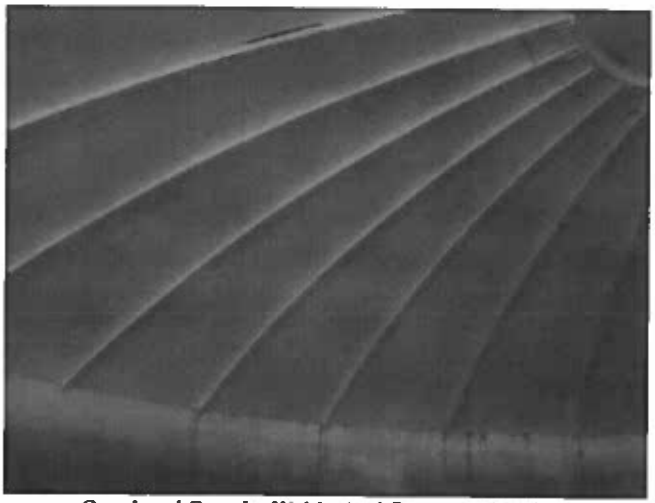
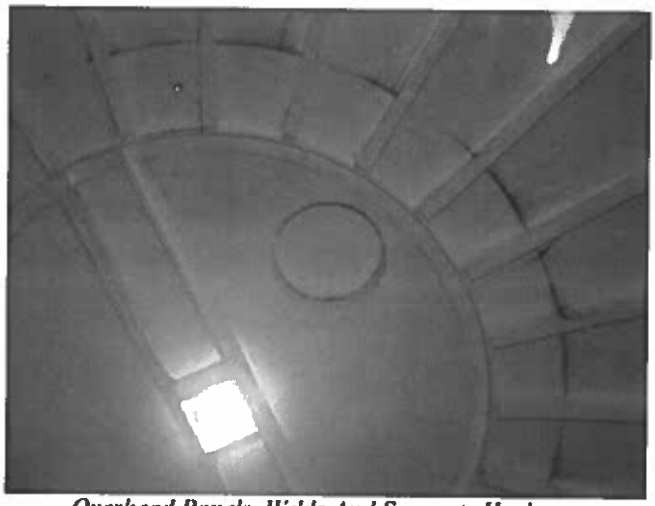
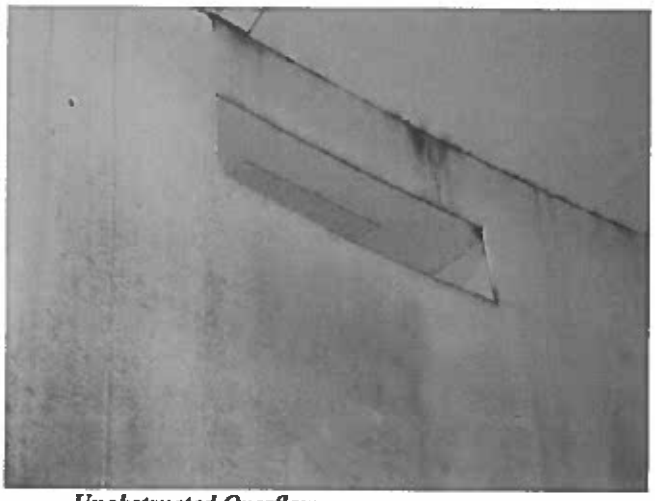


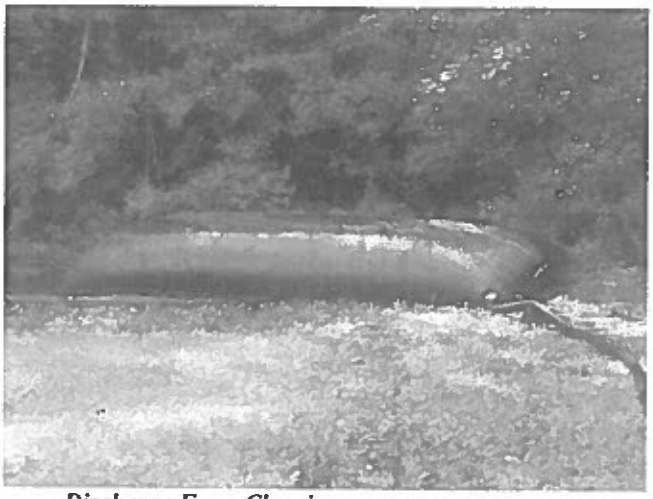
77 *Overhead Panels, Welds And Supports Having Corrosion Bleed-Through*



78 *Overhead Panels, Welds And Supports Having Corrosion Bleed-Through*



79 ***Unobstructed Overflow***



80 ***Discharge From Cleaning***

UNDERWATER SOLUTIONS INC

SERVICES COMPLETED:	Inspection and Cleaning
CUSTOMER NAME:	Ware Department of Public Works
ADDRESS:	4 1/2 Church Street Ware, MA 01082
TANK NAME:	Church Street
SIZE:	1.5-Million-Gallon
TYPE OF TANK:	Steel Water Storage Tank
DIMENSIONS:	40'H x 80'D

UNDERWATER SOLUTIONS INC

INSPECTION AND INTERIOR CLEANING (SEDIMENT REMOVAL) OF THE CHURCH STREET 1.5-MILLION-GALLON WELDED STEEL WATER STORAGE TANK

WARE DEPARTMENT OF PUBLIC WORKS
WARE, MASSACHUSETTS

AUGUST 6, 2020

SCOPE:

On August 6, 2020, Underwater Solutions Inc. completed an inspection of the Church Street 1.5-million-gallon welded steel potable water storage tank to provide information regarding the overall condition and integrity of this structure and removed the sediment accumulation found on the floor.

EXTERIOR INSPECTION:

The entire exterior of this water storage tank was inspected to include walls and coating, concrete foundation, manways, ladder, overflow, roof, vent and hatch.

The exterior of this structure was found having similar conditions as were found during a previous inspection completed by Underwater Solutions Inc. on December 16, 2015.

Walls And Coating

The exterior steel wall panels and associated welds were inspected and found appearing sound and free of obvious fatigue or failures at this time.

The protective coating applied to these welded steel surfaces was found having poor adhesion value.

Adhesion loss of the finish coat was observed throughout approximately 35% of these surfaces, resulting in exposure of a primary coating. The primary coating within these areas of steel exposure appeared to have good adhesion value at this time.

Isolated areas of coating loss were observed throughout less than 5% of the lowest row of wall panels, resulting in exposure of the underlying steel. Corrosion exists within each area of steel exposure, and fatigue (pitting) of the steel having depths ranging from barely detectable levels up to 1/16" deep was observed within these areas of steel exposure at this time.

Spray-painted graffiti exists throughout the lowest 8' of the exterior walls and a moderate to heavy, non-uniform accumulation of mildew throughout the exterior walls has declined the overall aesthetics.

It is our recommendation to monitor the wall panels showing fatigue (pitting) of steel through future scheduled inspections to ensure that the depth of fatigue (pitting) of the steel does not increase in depth and result in the potential for leakage.

Concrete Foundation

The exposed surfaces of the 2" wide concrete foundation ranges from 5-14" in height is not coated and appeared mostly sound at this time.

Tight cracks were observed throughout less than 5% of these exposed surfaces at this time.

These cracks were sounded and appeared to be limited to the surface of the concrete and remain free of voids or spall at this time.

The sealant applied throughout the circumference of the tank at the junction of where the foundation and tank base meet remains having good adhesion value, preventing moisture from penetrating and accumulating beneath the tank.

It is our recommendation to monitor the cracks found throughout the exposed foundation surfaces through future scheduled inspections to ensure that spall of the concrete does not occur and result in exposure of the reinforcement steel.

Manways

Two, 24" inside diameter manways penetrate the lowest row of wall panels on the north-easternmost and south-westernmost sides of the tank, located approximately 17" above the tank base and are securely installed and free of obvious leakage.

The protective coating applied to the north-easternmost manway was found having mostly good adhesion value at this time.

Minimal coating loss and steel exposure was found on the steel bar and single nut and bolt that secures the manway in place; however, no obvious fatigue of this steel hardware was evident at this time.

Adhesion loss of the protective coating was observed throughout less than 5% of the manway lid, resulting in exposure of the underlying steel. Corrosion exists within these areas of steel exposure, and fatigue (pitting) of the steel having depths ranging from barely detectable levels up to 1/16" deep was evident within these areas of steel exposure at this time.

It is our recommendation to monitor the surfaces of the manway lid showing steel fatigue (pitting) through future scheduled inspections to ensure that the depth of fatigue (pitting) does not increase and result in the potential for leakage.

The protective coating applied to the south-westernmost manway was found having mostly good adhesion value at this time.

Minimal coating loss and steel exposure was found on the steel bar and single nut and bolt that secures the manway in place; however, no obvious fatigue of this steel hardware was evident at this time.

Ladder

A welded steel ladder extends from approximately 16' above the ground on the north-easternmost side of the tank up to the roof dome, supported to the wall of the tank with two sets of welded standoffs. A fall prevention device is installed throughout the length of this ladder, providing safe access and egress to and from the roof.

The protective coating applied to the ladder and fall prevention device remains having good adhesion value at this time.

Overflow

An 8" inside diameter overflow pipe exits the base of a welded steel weir box that is welded to the top wall panel and extends down, is supported to the tank wall with two welded standoffs and terminates approximately 12" above a concrete splash pad.

This overflow pipe was free of obvious obstructions and a flap-valve installed at its end functions properly, however the outlet end of this pipe does not have a screen at this time.

The protective coating applied to the overflow pipe and weir box was found having good adhesion value at this time.

It is our recommendation to install a non-corrodible metal screen having 24-mesh within the outlet end of the pipe and behind the flap-valve in an effort to prevent access to the interior of the pipe/tank.

Roof

The steel roof panels, and associated welds were inspected and found appearing sound and remain free of obvious fatigue or failures at this time.

Adhesion loss of the finish coat was observed throughout approximately 10% of these surfaces, resulting in exposure of the primary coating. The primary coating within these areas of exposure appeared to have good adhesion value at this time.

Adhesion loss of the protective coating was observed throughout the circumference of the vent riser pipe, resulting in exposure of the underlying steel. No obvious fatigue of either the steel roof panels or steel, vent riser pipe was evident within these areas of steel exposure, rather mild corrosion exists at this time.

An accumulation of mildew and organic debris (pine needles) throughout the roof dome has declined the overall aesthetics.

It is our recommendation to monitor the roof panels at the vent riser penetration showing steel exposure through future scheduled inspections to ensure that fatigue of the steel does not occur.

Safety Railing

The angle iron safety railing located on the edge of the roof dome on the north-easternmost side of the tank appeared sound and remains free of obvious fatigue or failure at this time. The protective coating applied to these steel safety railings remains having good adhesion value at this time.

Vent

The vent is located within the center of the roof dome having a 10" inside diameter and stands 24" tall.

A 19" outside diameter steel cap and associated 4-mesh screen remains securely installed over this vent, however this vent does not have a cap that extends down to the base of the screen to prevent the access of wind driven rain and snow, while the current screen does not have 24-mesh.

The protective coating applied to the vent assembly was found having mostly good adhesion value, however isolated areas of coating loss was observed throughout less than 5% of these surfaces, resulting in exposure of the underlying steel. No obvious fatigue of the steel was evident within these areas of exposure, rather mild corrosion exists at this time.

It is our recommendation to remove the current screen from the vent and to install a replacement, non-corrodible metal screen having 24-mesh throughout the outside circumference of the vent in an effort to prevent access to the interior of the tank.

Hatch

Two, 24" inside diameter hatches provide good access to the tank interior through the roof.

The hatch located at the edge of the roof on the north-easternmost side of the tank was opened and utilized to access the tank interior for this inspection and cleaning. This hatch remains in good working condition and was found secured with a lock, preventing unwanted access to the interior of the tank.

The protective coating applied to the exterior of this hatch lid and trunk was found having mostly good adhesion value, however isolated areas of coating loss was observed throughout less than 5% of these surfaces, resulting in exposure of the underlying steel. No obvious fatigue of the steel was evident within these areas of exposure, rather mild corrosion exists at this time.

The protective coating applied to the interior of this hatch lid and trunk was found having mostly good adhesion value, however isolated areas of coating loss was observed throughout less than 5% of these surfaces, resulting in exposure of the underlying steel. No obvious fatigue of the steel was evident within these areas of exposure, rather mild corrosion exists at this time.

A second hatch located within the center of the roof was found secured with a series of nuts and bolts, preventing unwanted access and was not opened or used for this project.

The protective coating applied to the exterior of this hatch lid and trunk was found having mostly good adhesion value, however isolated areas of coating loss was observed throughout less than 5% of these surfaces, resulting in exposure of the underlying steel. No obvious fatigue of the steel was evident within these areas of exposure, rather mild corrosion exists at this time.

Although this hatch was not opened, the interior of this hatch was observed from within the tank and the protective coating applied to the interior of this hatch lid and trunk appeared to have good adhesion value at this time.

EXTERIOR RECOMMENDATION(S): It is our recommendation to pressure-wash the exterior of the tank, including the components affixed to the exterior of the tank at 3,500 P.S.I. using a 40° tip and an environmentally approved cleaning agent to remove all soluble/insoluble surface contamination, chalk and mildew from the exterior surfaces of this tank, followed by a clean water rinse to remove all cleaning residue.

It is also our recommendation to hand/power tool clean the surfaces of the tank showing coating fatigue to bare metal to achieve a uniform anchor profile and to re-coat these areas with a prime coat, intermediate coat and finish coat using protective coatings that are formulated for exterior exposure. These protective coatings should be applied in accordance with the product manufacturer's surface preparation and application recommendations in an effort to halt corrosion, prevent steel fatigue and to provide good protection for the steel.

We recommend that during the exterior rehabilitation of this tank, to remove the existing vent assembly and to install a replacement non-corrodible metal AWWA compliant fail-safe (frost -proof) vent having a non-corrodible 24-mesh screen over the vent penetration in the roof to allow for proper ventilation and to prevent access to the interior of the tank.

It is our recommendation that after exterior pressure-washing is complete, to hand/power tool clean the exposed surfaces of the foundation showing cracks to achieve a uniform anchor profile and to apply two coats of a masonry waterproofing coating to all cracks in an effort to seal the cracks and to prevent moisture penetration.
Prior to any re-habilitation it would be our recommendation to obtain a lead content sample of the protective coating applied to the exterior surfaces of the tank to determine the best course of rehabilitation.

INTERIOR INSPECTION:

The entire interior of this water storage tank was inspected, to include sediment accumulations, floor, manways, piping, walls and coating, overhead, support columns, overflow and aesthetic water quality.

Sediment Accumulations

A uniform layer of accumulated precipitate was found throughout the floor averaging 4" in depth.

After completing this inspection, all precipitate was vacuumed from the floor.

Floor

After removing all accumulated precipitate, the steel floor panels, and associated welds were inspected and appeared sound and remain free of obvious fatigue or failures of the steel at this time.

The protective coating on these steel panels and welds appeared to have been applied uniformly and remains having good adhesion value, providing good protection for these steel panels and welds.

Mild to moderate staining remains throughout the floor due to the accumulation of precipitate.

Manways

Two, 24" inside diameter manways penetrate the lowest row of wall panels on the north-easternmost and south-westernmost sides of the tank, located approximately 17" above the floor and are securely installed and free of obvious leakage.

The protective coating applied to each manway lid, trunk and davit hinge appeared to have been applied uniformly and was found having mostly good adhesion value at this time.

Adhesion loss of the coating was observed throughout approximately 10% of each manway assembly, resulting in exposure of the underlying steel. No obvious fatigue (pitting) of either manway lid or trunk or deterioration of either davit hinge was evident within these areas of steel exposure, rather mild to moderate corrosion exists at this time.

It is our recommendation to monitor the surface of each manway lid, trunk and davit hinge showing steel exposure through future scheduled inspections to ensure that fatigue/deterioration of the steel does not occur.

Piping

The influent/effluent pipe penetrates the tank floor approximately 11" in from the wall on the southernmost side of the tank having a 10" inside diameter and is flush with the floor of the tank.

A 10" inside diameter by 6" tall removable riser is installed above this pipe serving as a silt stop.

This pipe was free of obvious obstructions and was without flow at the time of this inspection.

The protective coating applied to the removable steel silt stop riser appeared to have good adhesion value at this time.

The protective coating applied to the exposed surfaces of the pipe penetration in the floor was found to be blistering throughout approximately 90% of all surfaces. Approximately 25% of these coating blisters have ruptured, resulting in exposure of the underlying steel. No obvious fatigue of the steel was evident within these areas of exposure, rather mild to moderate corrosion exists at this time.

It is our recommendation to monitor the exposed interior surfaces of the pipe penetration in the floor through future scheduled inspections to ensure that fatigue of the steel does not occur.

Walls And Coating

The interior walls were inspected beginning at the floor and by spiraling the circumference of the tank up to the surface.

These steel wall panels and associated welds appeared sound and remain free of obvious fatigue or failures of the steel at this time.

The protective coating on these steel panels and welds appeared to have been applied uniformly and remains having good adhesion value, providing good protection for the steel panels and welds.

A heavy stain to a film of precipitate exists throughout the interior wall surfaces beginning approximately 10" below overflow level and extends down to the floor.

Overhead

The entire overhead was inspected from the water surface.

These steel panels, welds, and channel iron supports, including the hardware that secures the channel iron supports to the connecting plates welded to the top row of wall panels appeared sound and remain free of obvious fatigue or failure at this time.

The protective coating on these steel panels and channel iron supports appeared to have been applied uniformly and appears to have good adhesion value, however mild corrosion bleed-through (blotch rusting) was observed throughout less than 5% of the panel edges and the edges of the channel iron supports.

No obvious exposure of the underlying steel was evident within these areas of corrosion bleed-through (blotch rusting), rather corrosion staining that extends down to the top row of wall panels exists at this time.

It is our recommendation to monitor the panel edge and angle iron support surfaces showing corrosion bleed-through through future scheduled inspections to ensure that adhesion loss of the protective coating does not occur and result in exposure of the underlying steel.

Support columns

Six, 8" diameter steel support columns extend up from 48" by 36" by 8" tall channel iron footers welded to the floor to 4" wide by 10" tall I-beam overhead supports.

A seventh, 8" diameter steel column located in the center of the tank, also extends up from a 48" by 36" by 8" tall channel iron footer to a 36" outside diameter by 1" thick steel plate that is bolted to the 2" wide by 6" tall channel iron overhead supports.

Each support column, including all securing hardware appeared sound and remain free of obvious fatigue or failure at this time.

The protective coating on each column and footer appeared to have been applied uniformly and remains having good adhesion value at this time.

A heavy stain to a film of precipitate exists throughout the surfaces of each support column beginning approximately 10" below overflow level and extends down to the floor.

Overflow

The overflow consists of an 18" long by 3" wide cutout within the top wall panel on the north-easternmost side of the tank, located approximately 12" below the junction of where the roof and walls meet.

This overflow cutout was free of obvious obstructions at the time this inspection was completed.

Aesthetic Water Quality

The aesthetic water quality within this tank was found to be fair. Suspended particulate and color throughout all elevations of the water column reduced or visibility to approximately 60" and prevented high-quality photographic documentation.

INTERIOR RECOMMENDATION(S): It is our recommendation that the next time this tank is removed from service and de-watered, to pressure-wash the interior floor, wall and support column surfaces at 3,500 P.S.I. using a 40° tip and an N.S.F. 60 approved cleaning agent to remove the staining/film of precipitate from these surfaces, followed by a clean water rinse in an effort to improve the aesthetic water quality.

It is also our recommendation to hand/power tool clean the surfaces of each manway assembly showing steel exposure to bare metal, ensuring any and all lifted edges of the coating are feathered back tight and to spot-coat the surfaces of each manway showing steel exposure with a prime coat, intermediate coat and finish coat, using protective coatings that are formulated for immersion (wet contact), having an A.N.S.I./N.S.F. 61 approval for use in structures containing potable water. These protective coatings should be applied in accordance with the product manufacturer's surface preparation and application recommendations in an effort to halt corrosion, prevent steel fatigue/deterioration and to provide good protection for the interior surfaces of each manway lid, trunk and davit hinge.

Prior to any re-habilitation it would be our recommendation to obtain a lead content sample of the protective coating applied to the interior surfaces of the tank to determine the best course of rehabilitation.

ADDITIONAL REMARKS/RECOMMENDATION(S):

It is our recommendation to install an N.S.F. approved active mixer within this structure to prevent ice cap formation and to improve overall water quality.

CONCLUSION:

It is the opinion of Underwater Solutions Inc. that welded steel potable water storage tank appeared mostly sound and remains free of obvious leakage at this time.

As always, we recommend that re-inspection and cleaning of all water storage facilities be performed in accordance with state and federal mandates, A.W.W.A. standards, and completed by an experienced and authorized inspection corporation.

UNDERWATER SOLUTIONS INC.

Christopher A. Cole, Project Manager

This report, the conclusions, recommendations and comments prepared by Underwater Solutions Inc. are based upon spot examination from readily accessible parts of the tank. Should latent defects or conditions which vary significantly from those described in the report be discovered at a later date, these should be brought to the attention of a qualified individual at that time. These comments and recommendations should be viewed as information to be used by the Owner in determining the proper course of action and not to replace a complete set of specifications. All repairs should be done in accordance with A.W.W.A. and/or other applicable standards.

1 *Exterior Wall Having Adhesion Loss Of The Finish Coating, Exposed Primary Coating And A Non-Uniform Accumulation Of Mildew*

2 *Exterior Wall Having Adhesion Loss Of The Finish Coating, Exposed Primary Coating And A Non-Uniform Accumulation Of Mildew*

3 *Exterior Wall Having Adhesion Loss Of The Finish Coating, Exposed Primary Coating And A Non-Uniform Accumulation Of Mildew*

4 *Exterior Wall Having Adhesion Loss Of The Finish Coating, Exposed Primary Coating And A Non-Uniform Accumulation Of Mildew*

5 *Exterior Wall Having Adhesion Loss Of The Finish Coating, Exposed Primary Coating And A Non-Uniform Accumulation Of Mildew*

6 *Exterior Wall Having Adhesion Loss Of The Finish Coating, Exposed Primary Coating And A Non-Uniform Accumulation Of Mildew*

7 *Exterior Wall Having Adhesion Loss Of The Finish Coating, Exposed Primary Coating And A Non-Uniform Accumulation Of Mildew*

8 *Exterior Wall Having Coating Loss, Exposed Steel , Corrosion And A Non-Uniform Accumulation Of Mildew*

9 *Exterior Wall Having Coating Loss, Exposed Steel , Corrosion And A Non-Uniform Accumulation Of Mildew*

10 *Exterior Wall Having Coating Loss, Exposed Steel , Corrosion And A Non-Uniform Accumulation Of Mildew*

11 *Exterior Wall Having Spray-Painted Graffiti*

12 *Exposed Foundation Surfaces Appearing Sound*

13 *North-Easternmost Manway Having Minimal Steel Exposure On The Securing Hardware*

14 *South-Westernmost Manway Having Minimal Steel Exposure On The Securing Hardware*

15 *Ladder And Fall Prevention Device Having Good Adhesion Value Of The Coating*

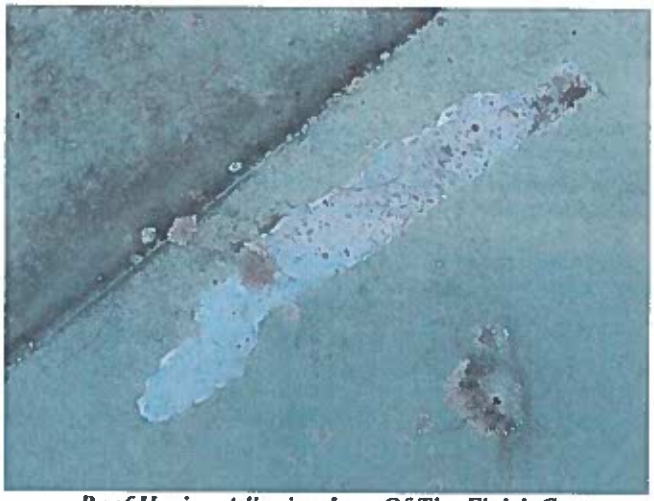
16 *Overflow Weir Box And Overflow Pipe Having Good Adhesion Value Of The Coating*

17 *Overflow Pipe Terminating Above A Concrete Splash Pad*

18 *Overflow Pipe Found Unobstructed*

19 *Roof Having Adhesion Loss Of The Finish Coat, Exposed Primary Coating, And A Non-Uniform Accumulation Of Mildew*

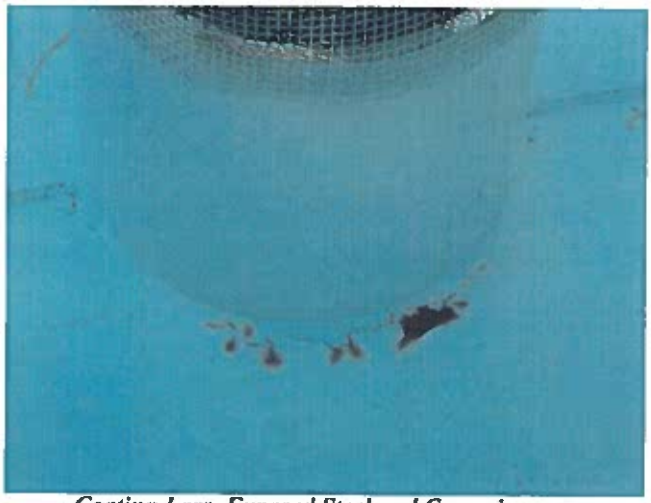
20 *Roof Having Adhesion Loss Of The Finish Coat, Exposed Primary Coating, And A Non-Uniform Accumulation Of Mildew*



21 *Roof Having Adhesion Loss Of The Finish Coat, Exposed Primary Coating, And A Non-Uniform Accumulation Of Mildew*

22 *Roof Having Adhesion Loss Of The Finish Coat, Exposed Primary Coating, And A Non-Uniform Accumulation Of Mildew*

23 *Roof Having Adhesion Loss Of The Finish Coat, Exposed Primary Coating, And A Non-Uniform Accumulation Of Mildew*



24 *Coating Loss, Exposed Steel and Corrosion Throughout The Vent Base*

25 *Safety Railings Having Good Adhesion Value Of The Coating*

26 *Vent Having A Secure Screen*

27 *Hatch Interior Having Exposed Steel And Corrosion*

28 *Hatch Exterior Having Exposed Steel And Corrosion*

29 *Hatch Secured With A Lock*

30 *Hatch Secured With Nuts And Bolts*

31 *Hatch Exterior Having Exposed Steel And Corrosion*

32 *Hatch Interior Appearing To Have Good Adhesion Value Of The Protective Coating*

33 *Layer Of Precipitate*

34 *Floor Having Good Adhesion Value Of The Protective Coating And A Mild To Moderate Stain*

35 *Floor Having Good Adhesion Value Of The Protective Coating And A Mild To Moderate Stain*

36 *Manway Having Exposed Steel And Corrosion*

37 *Manway Having Exposed Steel And Corrosion*

38 *Manway Having Exposed Steel And Corrosion*

39 *Manway Having Exposed Steel And Corrosion*

40 *Unobstructed Influent/Effluent Pipe*

41 *Interior Surfaces Of The Pipe Having Exposed Steel And Corrosion*

42 *Interior Wall Having A Heavy Stain To A Film Of Precipitate*

43 *Interior Wall Having A Heavy Stain To A Film Of Precipitate*

44 *Interior Wall Having A Heavy Stain To A Film Of Precipitate*

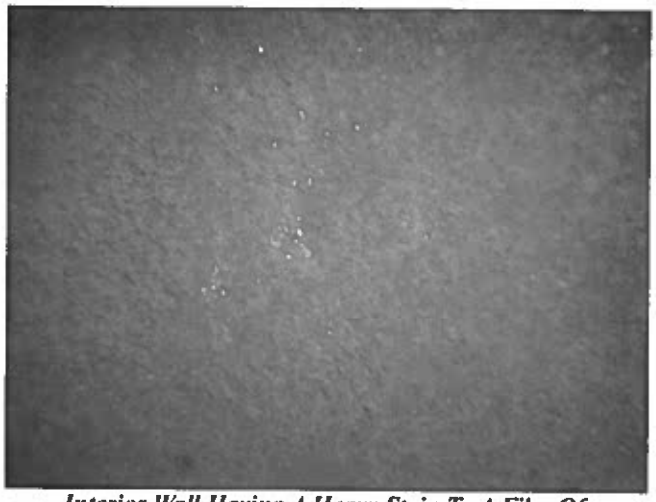
45 *Interior Wall Having A Heavy Stain To A Film Of Precipitate*

46 *Interior Wall Having A Heavy Stain To A Film Of Precipitate*

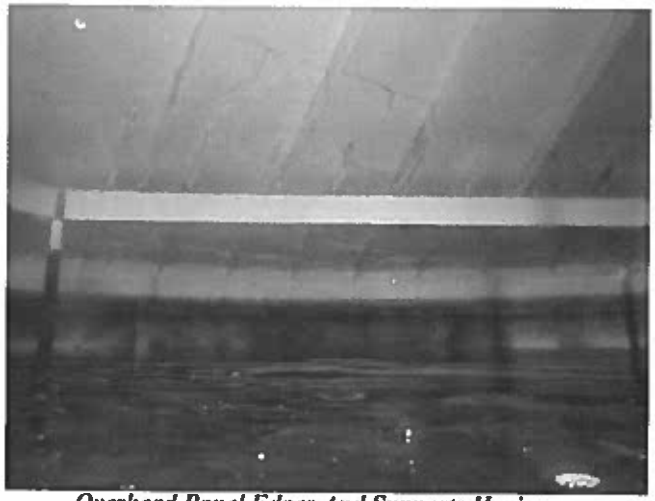
47 *Interior Wall Having A Heavy Stain To A Film Of Precipitate*

48 *Interior Wall Having A Heavy Stain To A Film Of Precipitate*

49 *Interior Wall Having A Heavy Stain To A Film Of Precipitate*

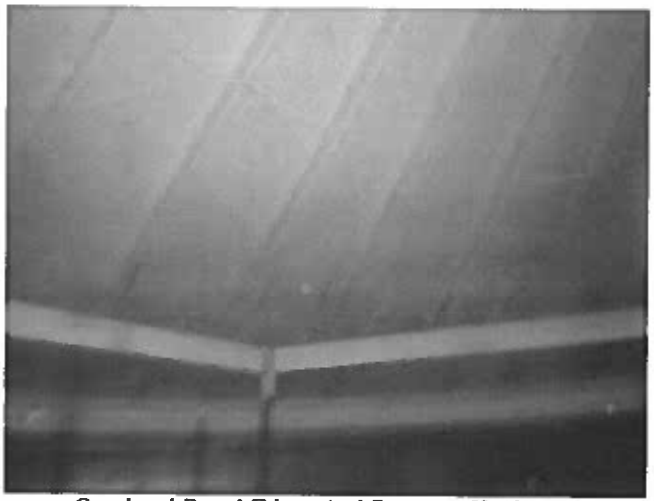


50 *Interior Wall Having A Heavy Stain To A Film Of Precipitate*



51 *Overhead Panel Edges And Supports Having Corrosion Bleed-Through (Botch Rusting)*

52 *Overhead Panel Edges And Supports Having Corrosion Bleed-Through (Botch Rusting)*



53 *Overhead Panel Edges And Supports Having Corrosion Bleed-Through (Botch Rusting)*

54 *Overhead Panel Edges And Supports Having Corrosion Bleed-Through (Botch Rusting)*

55 *Overhead Panel Edges And Supports Having Corrosion Bleed-Through (Botch Rusting)*

56 *Support Column Footer Having Good Adhesion Value Of The Coating*

57 *Support Column Footer Having Good Adhesion Value Of The Coating*

58 *Support Column Having Good Adhesion Value Of The Coating And A Heavy Stain To A Film Of Precipitate*

59 *Support Column Having Good Adhesion Value Of The Coating And A Heavy Stain To A Film Of Precipitate*

60 *Support Column Having Good Adhesion Value Of The Coating And A Heavy Stain To A Film Of Precipitate*

61 *Support Column Having Good Adhesion Value Of The Coating And A Heavy Stain To A Film Of Precipitate*

62 *Support Column Having Good Adhesion Value Of The Coating And A Heavy Stain To A Film Of Precipitate*

63 *Support Column Having Good Adhesion Value Of The Coating And A Heavy Stain To A Film Of Precipitate*

64 *Support Column Having Good Adhesion Value Of The Coating And A Heavy Stain To A Film Of Precipitate*

65 *Support Column Having Good Adhesion Value Of The Coating And A Heavy Stain To A Film Of Precipitate*

66 *Support Column Having Good Adhesion Value Of The Coating And A Heavy Stain To A Film Of Precipitate*

EXHIBIT # 3

WRIGHT-PIERCE
Engineering a Better Environment

Memorandum

Date: **11/2/2022**

Project No.: **21214A**

To: **City of Ware MA Water Department**

From: **Scott Hinckley, PE**

Subject: **Water Telemetry and Control System Upgrade Preliminary Design Technical Memo**

1.0 INTRODUCTION

The City of Ware Water Department operates a water distribution system consisting of 5 wells, two water treatment facilities, two water storage tanks and a small water booster station. The existing telemetry system that transmits data between the sites is failing and difficult to repair due to its age. In addition, the controls systems at the sites are over 20 years old using obsolete equipment. This preliminary design technical memo will evaluate the existing telemetry and control systems and propose improvements that will form the basis of the final design phase of the project.

Project Goals:

- The primary goal of the project is to replace the existing telemetry system
- A secondary goal is to update the control system at each location as required for the new telemetry systems and to improve the operations of the water system.

This technical memo contains the following Sections:

Existing Conditions – Describes the existing control systems at each of the water sties

Basis of Design – A description of the proposed improvements to the telemetry and control systems at each water site which will be used to develop contract specification and drawings for competitively bid.

Cost Estimate – Estimated Construction Cost for the proposed project

Attachments – relevant information including:

- Radio Path Study
- Cost Breakdown

2.0 EXISTING CONDITIONS

2.1 Barnes Street Water Treatment Plant

The Barnes Street Water Treatment Plant (WTP) is housed in a historic brick building. A Motor Control Center (MCC), Generator and existing Main Control Panel is in the Office/Common area of the building. The other part of the building includes a large process area with chemical additional and finish water monitoring. A second building across the street from the WTP houses a raw water Cistern.

2.1.1 Barnes Steet Water Treatment Plant and Wells 1-4.

The Barnes Street Water Treatment Plant consists of four source water wells, a raw water cistern with booster pumps and a water treatment plant. Wells No. 1 through No. 3 operate together while well No. 4 operates independently in a lead/lag arrangement to maintain the level of raw water in the cistern. The Lead and Lag Pumps are selected by the operator using a "Well Pump SEQ" selector switch located on a control section of the Motor Control Center (MCC). The lead and lag pumps are activated by a series of three float switches mounted in the Cistern and relay logic located in the MCC. The float switches correspond to:

- High Water Level Alarm
- Lag Well Pump(s) Start
- Lead Well Pump(s) Start
- Well Pumps Stop
- Low Water Level Alarm

Each Well Pumps No. 1 through 3 is connected to Full Voltage Non Reversing (FVNR) type motor starters located in an MCC section at the WTP. Hand controls on the front of these MCC sections include a Hand-Off-Auto, RUN and STOP indicator lights, Motor Overload reset, power disconnect and an Elapse Time Meter (ETM). Based on the electrical drawings for the MCC, each well pump control includes contacts to RUN status and remote start when placed in Auto. Well 4 is connected to a motor starter located at the well and activated using a hard wire circuit from relay logic in the existing MCC.

The Town has replaced the pumps in wells No. 1 and No. 4 with high lift pumps with enough hydraulic head capacity to pump directly to the distribution system. Eventually the Town would like to replace all the well pumps will high lift pumps and abandon the Cistern and Booster Pumps.

The MCC includes a section with a compressor and air tubing to each well that allows the operators to examine the level of water in each well. The operator can push a button for each well that activates the compressor and opens a solenoid valve on the air line to the well. The depth of water in the well is read on an analog gauge.

2.1.2 Raw Water Cistern and Booster Pumps

The water level in the Cistern is measured by a 10-15 year old submersible pressure transducer. The measured level is displayed and historical recorded on a Foxboro chart recorder wall mounted in the Cistern Building. The level measurement is not used for control of the wells or booster pumps.

Two raw water booster pumps (Booster Pumps No. 1 and 2) operating as lead/lag arrangement to pump water from the Cistern and through the WTP where it is chemically treatment and monitored before discharged to the distribution system. The cistern is a round concrete tank approximately XX in depth with an operating volume of 25,000 gallons.

Booster Pumps are FVNR motor starters located in an MCC section at the WTP. Controls located on the front of the MCC section include:

- Hand-Off-Auto selector switch
- RUN (green) and STOP (red) indicator lights,
- Overload (OL) reset pushbutton
- Power Breaker
- Elapse Time Meter (ETM).

The discharge flow rate from the booster pumps was originally measured by a venturi flow meter with a differential pressure type flow transmitter using an AGM pulse duration transmitter to transmit the flow rate to the WTP. The flow meter and the AGM are not functional and are no longer used. The flow rate is currently measured by a newer Electromagnetic flow meter on the finished water line in the process area of the WTP.

2.1.3 Chemical Feed Systems

The Barnes station inject Sodium hypochlorite (NaOCL) for disinfection and Potassium Hydroxide (KOH) to adjust the pH of the finished water. The two chemicals are stored in tanks with Flowline ultrasonic level sensor mounted to the tops of the tanks to measure the liquid level. The NaOCL has two tanks while the KOH is stored a single bulk storage tank and then manually transferred to a Day Tank using a transfer pump. The level in each of the three

storage tanks is transmitted to a local stainless steel level indicator panel, however, the KOH indicator is currently missing. The level in each tank is transmitted to the Main Control Panel.

Two metering pumps draw KOH from the Day Tank and inject the chemical into the finish water. Each pump consists of a LMI Milton Roy Series G diaphragm pump with DC motor connected to a SCR variable speed drive (Model VS DC2 manufactured by Reliance Electric). The SCR drive includes integral toggle switches for Auto-Manual speed selection, and manual speed pot and Hand-Off-Auto control switch. A separate TACH indicator provided speed feedback from the drive.

The NaOCL is pumped from Hypochlorite Tank No 1 by two LMI B911 series solenoid pumps. Each of the pumps is connected to a local pump monitor (Model ALM-9 by Northeast Pump and Instrument Company) which provides automatic fail over if the active pump has a fault and generates an alarm contact. The alarm is not currently connected to the control system.

The chemical pumps are enabled through a relay contact and are paced using a common flow signal from an electromagnet flow meter on the finish water line. The current control of the metering pumps does not appear to meet the Massachusetts Chapter 6 Guidelines for critical chemical control since the chemical pumps are not directly interlocked, either through hardwire or software, to shut down on low finish water flow and high ph/residual in the finish water. The pumps also to not include a local control station to prevent operation in Hand mode for extended periods of time along with an alarm condition that the chemical pump is operating in Hand.

2.1.4 Finish Water Monitoring

The finish water is monitored for chemical and physical properties by existing instruments prior to being discharged to the water distribution system.

- pH and temperature: HACH SC200 with a digital pH Probe and integral temperature sensor
- Chlorine Residual: HACH CL17 reagent based free chlorine analyzer
- Flow Rate: Siemens Electromagnetic Flow Meter

These instruments are functional and appear to be in good working order. The date of their last certified calibration is unknown.

2.1.5 Building Monitoring

The Barnes Street WTP has basic analog power monitoring at the MCC and a backup generator with Automatic Transfer Switch to supply backup power. The security at the site is monitored by a separate security system. There is no building HVAC or temperature monitoring.

2.1.6 Control System

The WTP is monitored and controlled based on hardwire relay logic in the MCC and programming in the Main Control Panel located on the wall adjacent to the MCC. A section of the MCC has hand controls for operation of the WTP:

- Church St and Anderson Tank Selection Switch: Determine which tank will activate the booster pumps
- Booster Pump Lead/Lag selector switch (1-2 or 2-1): To select pump 1 or 2 as the lead and lag booster pump.
- Booster pump Lead Required indicator light (green): indicates when the lead booster pump is called for to run
- Booster pump Lag Required indicator light (green): indicates when the lag booster pump is called for to run
- Well Pump Lead/Lag selector switch (3 wells or GPW well/Well 4): To select well pump 1, 2 and 3 or well 4 as the lead and lag well pump(s).
- Well pump Lead Required indicator light (green): indicates when the lead booster pump is called for to run
- Well pump Lag Required indicator light (green): indicates when the lag booster pump is called for to run
- Chemical Pump Lead/Lag selector (not used)
- Gravel Packed Well (Well No 4) Hand-Off-Auto: selector switch allowing remote Hand-Off-Auto control of Well No. 4.

The Main Control Panel was designed, installed, and programmed by Elm Electric Company in 1997 and consist of a NEMA 12 painted steel double door enclosure housing a Programmable Logic Controller (PLC). The existing PLC is an Allen Bradley SLC 5/04 with 1756 IO (PLC Layout shown below) mounted in a 10 slot backplane and is currently monitors only a few key pieces of information from the WTP along with the Distribution Tank Levels. Most of the existing IO in the control panel is spare.

Two selector switches on the front of the Main Control Panel are marked "Chart Recorder-PLC". The operator can select to run either booster pumps based on relay contacts in an existing chart recorder or PLC controls for either Booster Pump 1 or 2. The chart recorder is located on the end of the MCC and is used to historically display the levels in the Anderson and Church Street Tanks. When "PLC" is selected, the Booster Pumps are automatically started based on Start and Stop water levels in the selected Distribution Tank, which is the normal mode of operation.

An Allen Bradly Panelview (Model 2711-T9C8) operator interface terminal (OIT) is mounted to the front of the Main Control Panel and used to show the status of the water system. The OIT has color, touch screen interface with DH+ communications to the PLC.

TABLE 2.1.6 Barnes WTP Existing Main Control Panel IO Layout

Barnes WTP Main Control Panel PLC Layout
Ware MA Water Tleemtry and Control System Upgrade

	SLOT									
IO Point	0	1	2	3	4	5	6	7	8	9
Module	S/04 CPU	NI4 (4-20 mA AI)	NI4 (4-20 mA AI)	NO4I (4-20 mA AO)	Spare	Spare	AI16 (120V DI)	OW16 (relay out)	Spare	Spare
0		Distribution Tank Level	KOH Day Tank Level	spare			spare	Booster Pump #1 Start		
1		Finish Water pH	Chlorine Tank 1 Level	spare			spare	Booster Pump #2 Start		
2		Chlorine Residual	Chlorine Tank 2 Level	spare			spare	Alarm Acknowledge to Dialer		
3		KOH Tank Level	spare	spare			spare	Intrusion Alarm to Dialer		
4		Spare	spare	spare				Fire Alarm to Dialer		
5										
6										
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15										

2.2 Well No. 5

Well No. 5 (also referred to as the Gilbertville Pump Station or Dismal Swap Pump Station) is located in a field and pumps water approximately 500 feet to a precast concrete water treatment building. At the building, the water is treated with sodium hypochlorite for disinfection and sodium hydroxide for pH adjustment before being discharged to the distribution system.

2.2.1 Well Pump 5

Well pump 5 is connected to a Variable Frequency Drive (Yaskawa Model P1000). The VFD can vary the motor speed and subsequent discharge rate of the pump, which is set at a fixed speed and fixed flow rate by the operators. A backup reduced voltage Soft Start (SS) manufactured by Square D is available in case the VFD should fail. Both drives are in a wall hung drive panels located inside the water treatment building. The drive system has the following front mounted hand controls:

- VFD RUN light (green)
- VFD STOP light (red)
- VFD Ready light (blue)

- SS Ready Light (blue)
- VFD-OFF-SS selector Switch
- HAND-OFF-AUTO selector switch
- VFD Human Machine Interface (HMI)
- SS HMI
- Disconnect switch

The water level in the well is monitored by an existing submersible pressure transducer which is connected to the control system at the station.

2.2.2 Chemical Feed Systems

The Well 5 station injects Potassium Hydroxide (KOH) to adjust the pH of the finished water. The chemical is stored in a KOH Bulk Tank stored and manually transferred to the a day tanks. The level in the tanks is measured using Flowline Echopod ultrasonic level sensor mounted to the tops of the tanks. The levels are transmitted to a local indicator panel which displays the level in gallons and retransmitted to the Main Control Panel.

The chemical system has two solenoid chemical metering pumps (LMI C911 series) to pump chemical from the day tanks to the water line. Only one of the pumps is required to operate while the other pump is a standby pump. The standby pumps are manually switched off by the operators as the control system send a common start command to both chemical metering pumps. The chemical pumps are paced proportional to flow from separate speed reference signal from the control system. The operator adjusts the dosage rate of each pump using by adjusting the pumps internal configuration and stroke length.

Each chemical pump is connected to a local control station with an Auto-Off-Manual selector switch, Start Timer pushbutton and a Manual indicator light (green) and includes a twist lock type receptacle to supply power to the pump. The local control stations are manufactured by NPI and meet the Mass Chapter 6 Critical Chemical Feed requirements. However, one of the Mass Chapter 6 requirements is that each local control station should send an alarm to the control system when the pump is manually operated. The current PLC does not appear to monitor this condition.

2.1.4 Finish Water Monitoring

The finish water is monitored for chemical and physical properties by existing instruments prior to being discharged to the water distribution system.

- pH and temperature: HACH SC200 with a digital pH Probe and integral temperature sensor
- Chlorine Residual: HACH CL17 reagent based free chlorine analyzer
- Flow Rate: Badger Turbine Flow Meter with ER-9 indicator/transmitter.

These instruments are functional and appear to be in good working order. The date of their last certified calibration is unknown.

2.1.5 Building Monitoring

The Well 5 Water Treatment building includes fire and security monitoring. These alarms are currently transmitted to the Barnes Street WTP where they are hardwire connected to the existing security and fire systems for alarm notification. Additional existing building monitoring connected to the control system includes:

- Low building temperature
- Power Loss
- Emergency Eyewash Flow
- Chemical Sump High Level

2.1.6 Control System

The Well 5 Control Panel is the same as the Main Control Panel at the Barnes Street WTP as described above. The only differences are as follows:

- The OIT appears to be a more recent version but still retains the DH+ communications with the PLC.
- The control panel include two front panel mounted chart recorders (Westronics CCR 600) used to monitor PH, flow rate and water level in the well.

The PLC also monitors more local status and alarm information than the PLC at eh Barnes WTP as shown in the Existing IO Layout Below.

The control panel include a Datalinc Inc DL4000 serial modem connected to a second serial modem located in the Main Control Panel at the Barnes WTP. The modems provide a communication link between the two PLC to exchange data. These modems are obsolete and no longer manufactured or supported.

Table 2.1.6 Well No 5 Existing Control Panel PLC IO Layout

Well No. 5 Control Panel PLC Layout
Ware MA Water Telemetry and Control System Upgrade

	SLOT									
IO Point	0	1	2	3	4	5	6	7	8	9
	S/04 CPU	NI4	NI4	NO4I	spare	spare	At16 (120V DI)	OW16 (relay out)	spare	spare
0		Well Flow	CL Residual	NaOH Pump 1 Speed			Well Pump Run Status	Well Pump Start/Stop		
1		Well Level	PH	NaOCL Pump 1 Speed			Well Pump Not In Auto	Chemical Pumps Run		
2		NaOH Tank Level	Discharge Pressure	NaOH Pump 2 Speed			Chemical Sump High Level			
3		NaOCL Tank Level	spare	NaOCL Pump 2 Speed			Emerg. Eyewash Flow			
4							Power Fail			
5										
6							Low Building Temp			
7							NaOH Tank High Level			
8							NaOCL Tank High Level			
9							Building Intrusion			
10							Fire Alarm			
11							Generator Alarm			
12										
13										
14										
15										

2.3 Church Street Tank and Booster Station

The Church Street Tank is 30 foot tall, steel water tank with a 1.5 million gallon storage capacity. The level in the tank is measured by a Siemens gage pressure transducer with indicator (ft of H2O) wall mounted in a valve pit adjacent to the tank. The pressure transducer is in working order and has a calibration sticker dated 7-2-2021. The water level is transmitted to the Barnes Street WTP using an AGM transmitter located in a NEMA 4 wall mounted steel enclosure and connected to a leased telephone line.

A small booster station is located on the tank site which maintains water pressure for a few customers located near the tank. The station is a small subgrade block structure with wood roof housing a horizontally coupled centrifugal booster pump and two large hydropneumatics tanks. The pump is constant speed and activated by a hydraulic pressure switch on the discharge line from the station. A small indicator station located at the door of the station includes indicator light for Pump On (green), Pump Off (red) and Power (blue).

2.4 Anderson Tank

The Anderson Tank is 60 foot tall, steel water tank with a 1.0 million gallon storage capacity. The level in the tank is measured by a Siemens gage pressure transducer with indicator (ft of H2O) wall mounted in a valve pit adjacent to the tank. The pressure transducer is in working order. The water level is transmitted to the Barnes Street WTP using an AGM transmitter located in a NEMA 4 wall mounted steel enclosure and connected to a leased telephone line.

3.0 BASIS OF DESIGN

3.1 Barnes Street Water Treatment Plant (WTP)

3.1.1 Instruments:

New Cistern Submersible Level Sensor and Level Indicator. The existing cistern level sensor is functional but has been in use for over 10 years. The level sensor will be replaced with a new submersible level transducer located in the same location as the existing sensor and utilizing the existing stilling well. The existing chart recorder will be replaced with a new level indicator which will display the level in the cistern and retransmit the level to the Main Control Panel in the WTP.

New Well No. 1 through No. 3 Water Level Pressure Transducer: The operator can currently select and measure the water level in each well No. 1 through 3. A compressor in the MCC provided compressed air to air piping extending down each well. A pressure gauge on the air line provides the operator with a visual indication of the water level in feet. Pushing a button for each well 1 through 3 on the front of the panel activates the compressor and a solenoid on the air line to the associated well. This system can continue to be used to measure the level in the wells. The solenoid and push buttons can be connected to the control system which measure the water level on a timed sequence or on demand when the button is pushed. A new pressure transducer on the main line will measure the level and transmit the level measurement to the control system.

New Chemical Tank Level Probes and level indicators: The existing level probes on the chemical tanks are an older design and at the end of their recommended life (15 years). These will be replaced with new Flowline Echopods model DL24 (range 0.0 o 9.8 feet) and the same as utilized at Well 5. The level indicators in the existing panel will be replaced with new large display process indicators and configured to display the tank level in gallons. A relay in the KOH day tank level indicator will be interlocked to prevent the transfer pump from operating when the tank is over filled.

3.1.2 Main Control Panel Modifications:

The existing Main Control Panel appears to be in good working condition with enough space inside the panel to expand its capabilities. The existing PLC in the Main Control Panel is an Allen Bradley SLC 5/04 central processing unit (CPU) with a 120 VAC power supply and several Input/Output (IO) modules that interface and with the process systems using control and signal wiring. The SLC5/04 CPU has been discontinued and uses an discontinued DH+

communication protocol to communicate with the Operator Interface Terminal (OIT) on the front of the control panel. It does not include industrial Ethernet communication, which is used in most modern industrial control and telemetry systems. The PLC Power Supply and IO modules are still available but are also an older design. There are three options available to replace the existing PLC.

Option 1: Replace the existing 5/04 CPU with a 5/05 CPU. The 5/05 CPU is a newer version of the existing CPU with an Ethernet communication port instead of DH+ and can use the existing PLC program. However, this CPU is also currently listed as Active Mature by Allen Bradley, and very expensive with a MSRP of $13,000 for the CPU.

Option 2: The existing IO can be reused by replacing the CPU module with an Ethernet communication module (AENTR module) which would turn the existing PLC into an Ethernet Remote IO rack. A more modern Allen Bradley CPU can then be installed in the control panel and monitor and control the IO rack though Ethernet Communications. This is the least cost option to upgrade the PLC but reuses I/O module that will likely be discontinued and need to be replaced in the about 5 years.

Option 3: We are proposing to replace the entire PLC in the control panel with a modern Allen Bradley CompactLogix CPU and IO rack. This will require removal and rewiring the IO along with converting the existing PLC program. However, this option has the greatest longevity (10-20 years) with easier and cheaper part replacement and increased expandability.

We are proposing to use option 3 as the best long term solution to replace the existing PLC.

The existing PLC IO will need to be expanded to accommodate addition control requirements (refer to Attachment C – Barnes Street WTP Proposed PLC IO Listing). The number of IO including a minimum of 10% spare are listed in the table below:

Table 3.1.2 – Proposed Quantity of IO point in the Modified Barnes WTP Control Panel

Signal Type	Minimum Number of IO Required	Proposed IO Modules
Digital inputs (DI)	35 + 4 spare = 39	Two (2) 16 point 24VDC Input Modules One (1) 16 point 120VAC Input Module (48 total DI)
Digital Outputs (DO)	16 +2 spare = 18	Two (2) 16 Point 120VAC Relay Outputs Module (32 tot DO)

Analog Inputs (AI)	12 + 2 spare = 14	Two (2) 8 channel 4-20 mA Analog Input Modules
Analog Output (AO)	4 + 2 spare = 6	One (1) 8 channel 4-20 mA Analog Output Module (isolated)

Since the additional IO and signal wiring would require a significant modification to the existing control panel, we are proposing to replace the entire backplane of the control panel and reuse only the existing double door enclosure. This will save cost as the backplane can be factory built instead of requiring a field modification which would also shut down the Main Control Panel for an extended period of time.

The existing operator interface terminal is 10-15 years old (based on the model number) and communicated using DH+, which is no longer supported. The OIT will be replaced with a new 12-inch touchscreen, color display with Ethernet communications. We would recommend sole sourcing an Allen Bradley OIT as the existing OIT programming can continue to be used in the new display. This programming includes monitoring of the two distribution tank levels and Well 5 which will provide a backup to the SCADA system.

3.2 Well No. 5

3.2.1 Instruments

Finish Water Flow Meter: We would recommend replacing the existing Badger turbine flow meter with a new electromagnetic flow meter with wall mounted indicating transmitter like the one at the Barnes Street WTP. The Badger flow meter is still functional but is approximately 15 years old and near the end of its useful life. A new electromagnet (MAG) type flow meter has no moving parts to wear out, is more accurate and would last for another 15 to 20 years.

3.2.2 Control System Improvements

The following proposed improvements will be made to the Well 5 Control System:

- The existing Allen Bradley 5/04 PLC will be replaced with a new Allen Bradley Compact Logix L320ER PLC with IO modules. The existing control panel enclosure, power supplies and control panel internals will be reused.
- Replace the existing Allen Bradley Panelview with a new 12 inch Allen Bradley Panelview and update the existing OIT programming.
- The existing PLC program will be migrated to the new Compactlogix platform using the Allen Bradley migration tool. This will typically result in 60%-80% conversion.

- Modify the existing PLC programming to start and stop the chemical pumps independently and allow the operator to set the dosage rate from the OIT and SCADA instead of within the chemical pump configuration.
- Provide separate Start/Stop commands to each of the chemical metering pumps.
- Mass Chap 6 Required Improvements:
    - Connect a status contact from each chemical pump local control station to the PLC to alarm when a chemical pump is operating in manual.
    - Provide software interlocks in the PLC programming to disable the chemical feed pumps on an analyzer alarm and low flow and enable the chemical feed pumps only when the well 5 pump is confirmed to be operating

It should be noted that the existing PLC programming allocates IO for a future hypochlorite feed system including tank level monitor, feed pump control and chlorine residual monitoring. This programming and IO will be maintained in the proposed improvements.

3.3 Church Street Tank and Booster Station

3.3.1 Instruments:

Tank Level Transducer: The existing tank level transducer will be reused for measuring the water level in the distribution tank.

Booster Station Pressure: A new pressure transducer will be installed on the discharge lines from the booster station to monitor the system pressure in this zone. The

Booster Station Building Temperature: A new temperature sensor will be installed in the booster station to monitor the building temperature and activate high and low temperature alarm conditions

3.3.2 Control System Improvements:

A new Church Street Tank Control Panel will be mounted above grade on a new backer board near the tank and valve pit. The control panel will consist of a NEMA 4X stainless steel enclosure with thermostatically controlled heater containing an Allen Bradley Micro820 micro PLC (model 2080-LC20-20QWB) with Ethernet communications. This PLC has twelve (12) 24VDC inputs and seven (7) relay outputs, four 4-20 mA analog inputs and one (1) 4-20 mA analog output.

The IO at this site will include:

Type	Description

AI	Tank Level
AI	Booster Pump Discharge Pressure
AI	Booster Station Building Temperature
DI	Booster Pump Run/Stop status
DI	Booster Station Loss of Utility Power
DI	Control Panel Loss of Power
DI	Control Panel Intrusion

The control panel will be 120 VAC powered with a surge arrestor and a Uninterruptible Power Supply to maintain up to 4 hours of operation during a power outage. An outlet and manual bypass contactor will be included to allow the operators to connect a portable 120VAC generator for extended power outages.

A new radio modem located inside the control panel will connect the micro PLC with the control system at the Barnes Street WTP. A new omni directional antenna will be located at the top of the tank with a low loss antenna cable connecting the antenna to a bulkhead surge arrestor at the control panel.

3.3 Anderson Tank

3.3.1 Instruments:

Tank Level Transducer: The existing tank level transducer will be reused for measuring the water level in the distribution tank.

3.3.2 Control System Improvements:

A new Anderson Tank Control Panel will be mounted above grade on a new backer board near the tank and valve pit. The control panel will consist of a NEMA 4X stainless steel enclosure with thermostatically controlled heater containing an Allen Bradley Micro820 micro PLC (model 2080-LC20-20QWB) with Ethernet communications. This PLC has twelve (12) 24VDC inputs and seven (7) relay outputs, four 4-20 mA analog inputs and one (1) 4-20 mA analog output.

The IO at this site will include:

Type	Description
AI	Tank Level
DI	Control Panel Loss of Power
DI	Control Panel Intrusion

The control panel will be 120 VAC powered with a surge arrestor and a Uninterruptible Power Supply to maintain up to 4 hours of operation during a power outage. An outlet and manual bypass contactor will be included to allow the operators to connect a portable 120VAC generator for extended power outages.

A new radio modem located inside the control panel will connect the micro PLC with the control system at the Barnes Street WTP through the repeater at the Church Street Tank. A new directional antenna will be located at the top of the tank with a low loss antenna cable connecting the antenna to a surge arrestor at the control panel.

3.4 New Telemetry System

The primary goal of the project is to replace the existing leased line communications system due to it high cost, unreliable nature, aging communication equipment and limited capabilities. The most common types of telemetry systems are licensed radio, unlicensed radio or cellular. All of these utilize industrial Ethernet protocol to establish communication between controllers at each site. This allows all data connected to a controller to be shared between all sites.

3.4.1 Computer Radio Path Analysis

A computer model was developed that calculates the Receive Signal Strength Index (RSSI) of each radio path including a prediction of availability (%). The model is used to determine reliability of radio paths and to assist in

the design of the radio system at each site by changing the antenna gain, height and transmit power to obtain a reliable radio signal.

Table 3.4.1 below shows the proposed radio paths and calculated radio signal strengths (receive levels in -dB) and reliability (predicated Availability %) for the communication with each site based on the computer path analysis models.

A receive signal strength between -50 dBm and -85 dBm with a reliability of 99.9% or greater is considered a reliable radio path. Currently, all sites are predicted to have reliable paths using a licensed VHF radio frequency at 220 Mhz. Direct links between each site and the Barnes WTP were evaluated and found to provide unacceptable paths. The Radio Path Analysis report is included as Attachment B.

Table 3.4.1 Computed Radio Path Analysis Results

Site 1	Site 2	Distance (Miles)	Receive Signal Level (-dBm)	Predicted Availability (%)	Reliable Path (Yes/No)
Anderson Tank	Church Street Tank	2.4	-79	99.96	Yes
Barnes WTP	Church Street Tank	1.0	-71	99.99	Yes
Well 5	Church Street	1.0	-85	99.81	Yes

Radio Telemetry. Radio telemetry systems are comprised of wireless radio systems using dedicated radio frequencies or licensed frequency bands requiring an application to the Federal Communication Commission (FCC). Unlicensed frequencies for long distance applications are typically 900 Mhz spread spectrum or 2.4 Ghz. Licensed bands for data transmission are located in the VHF (215 to 222 Mhz) and UHF (450 to 470 MHz) ranges. A Radio path study using a computer model shows that a radio telemetry system using Ethernet Radio modems on an FCC licensed frequency (refer to attached Radio Path analysis) is feasible with up to 99.9% reliability. The Unlicensed frequency system would not produce reliable paths. This type of radio uses Ethernet communication to access data and therefore requires that the controller at each site also have Ethernet communication. These radios will require an application for a FFC licensed VHF220 frequency (217 to 222 Mhz). The Church Street Tank will need to act as a repeater for the other sites.

Advantages:

- Higher power and longer distances (up to 10W and 30 miles)
- No monthly fees
- More secure than cellular
- More stable
- Less turnover of equipment due to technology

Disadvantages:

- Lower bandwidth (<256 kbps or 0.256 Mbps)
- Higher maintenance (Owner maintains radio infrastructure and repeaters)
- Higher initial cost (approx. $2500 per site compared to $1200 per site for cellular)
- Requires obtaining and maintaining an FCC licensed frequency

Cellular Telemetry System. A cellular system uses cellular routers to communicate through a service provider such as Verizon and AT&T. The reliability of the system depends on the reliability of the cellular infrastructure. Our experience is that this type of communication can provide reliable communication. Verizon and AT&T provide connection using several different cellular plans. We would recommend a restricted private connection with static IP addresses for each site. The restricted network prevents anyone gaining access to the network unless you have one of the designated IP addresses. This type of connection does have a recurring monthly fee based on the amount of data sent, so it is important to properly set up communication and limit data usage. We have found a properly setup cellular system should cost about $15 per site per month for the plan. There is typically an initial setup fee of $500 for the account and IP addresses. Based on a preliminary investigation at each site, there is adequate cellular connectivity at each of the existing sites.

Advantages

- Easy to deploy and add additional sites (no FCC license or dedicated repeater required)
- Higher Bandwidth (up to 100 Mbps)
- Less Maintenance (infrastructure O&M by others)
- Low initial costs

Disadvantages

- Less power (<500 mWatts)
- Monthly Fees based on data used
- More frequent technology turnover (may require replacing routers more often as carrier technologies change)
- Potential security issues with internet access
  Requires a minimum cell reception at the site.

3.5 New SCADA System

A new SCADA system will be installed on a desktop type computer located in a common control area at the WTP. The SCADA system will communicate with the PLC in the Main Control Panel to collect data from the WTP along with data from each of the remote sites using a new telemetry system. The operators will be able to monitor and control each of the remote sites. The new SCADA system will consist of a personal computer system running SCADA software meeting the following minimum criteria:

- Mid Tower Desktop Computer System
- I7 or I9 Intel processors running at 3.6 Ghz
- 16 GB DRAM
- 500 GB Solid State Drive
- 2 TB Hard Drive
- Dual Network Cards with two 1GB RJ45 Ethernet ports
- Multi Monitor Workstation Graphics Card with onboard VRAM
- Dual 24-inch widescreen 4K color display monitors
- Broadband internet router with hardware firewall
- MS Windows Operating System

SCADA Software: There are several vendors that have Supervisory Control and Data Acquisition (SCADA) software used in the water/wastewater industry. The most popular are GE IFIX V6.1, Trihedral VTSCADA and Allen Bradley RSView. We have estimate that a 5000 tag license development version with up to five (5) thin clients would be sufficient for this project with additional room for further expansion. The estimate cost for this package is $20,500 for VTSCADA or RSView.

Historian: The SCADA software includes a database to collect, maintain and display historical data over time. The data is collected on adjustable intervals and stored on the hard drive on the SCADA PC. We would recommend backing up the archived data to a cloud drive.

Large Display Monitor: A minimum of a 50-inch LED wall mounted TV will be located in the control area and used to display the overview of the water treatment system including the status of the WTP, wells, the two water tanks and booster station.

Alarm Management: The SCADA software will include an alarm autodialer to send alarm condition to designated operations phone numbers by either text message, vocal annunciation, or email. The operator will be capable of acknowledging the alarm condition. The software autodialer is either integrated into the SCADA package or is provided by a third part such a TOPVIEW or WIN911.

Remote Monitoring. The SCADA software will include up to five (5) concurrent thin client licenses which will allow the operators to access real time control and monitoring information from the SCADA system on their cell phones, tablets or computer systems from a remote location. The SCADA computer system will be remotely accessed through a secured firewall on a broadband Internet connection.

4.0 COST ESTIMATE

Refer to Attachment B for the Cost Breakdown for the proposed project. A cellular telemetry system would result in a deduct of approximately $20,000 from the Estimated Project Total Cost.

Subject	Church Street Tank Control Upgrade Cost Estimate	
Project	Telemetry and Control System Upgrade Cost Estimate	
Client	Ware MA Water Departmennt	
By	Scott Hinckley	
Date	11/2/2022	
	DESCRIPTION	**COST**
	Barnes WTP	$119,739
	Well 5	$53,719
	Church Street Tank	$39,235
	Anderson Tank	$26,775
	Radio Telemetry System	$23,692
	SCADA System	$41,610
	Mobiliation/Demob	$15,000
	Subtotal	$319,770
	Contigency (15%)	$47,966
	Estimated Construction Cost	**$367,736**
	Engineering Cost	
	Preliminary/Final Design/Bidding (under Contract)	$95,400
	Construction Adminstration Services (estimated)	$70,000
	Estimated Project Total Cost	$533,000
	Project Budget	$515,000

ATTACHMENTS:

A COST BREAKDOWN

B RADIO PATH ANALYSIS

C BARNES ST WTP CONTROL PANEL PROPOSED IO LISTING

EXHIBIT # 4

McAlmond, Geoffrey

From: McAlmond, Geoffrey
Sent: Wednesday, December 7, 2022 10:04 AM
To: Nick Lachance
Subject: FW: Vehicle Inventory

Sewer Truck – Utility Body

Year.....2012
Make.....Ford
Model....SRWSUP (Single Rear Wheel Super Duty F-250)
Vin.....1FTBF2B66CEB84694
Plate #.....M86805
Mileage.....64169
Color.....Green

This is the only vehicle on the inventory for the Sewer Department

From: McAlmond, Geoffrey
Sent: Wednesday, December 7, 2022 8:09 AM
To: Nick Lachance <NLachance@aquarionwater.com>
Subject: FW: Vehicle Inventory

Water Department Vehicles are listed below

From: water, dpw <dpwwater@townofware.com>
Sent: Wednesday, December 7, 2022 8:05 AM
To: McAlmond, Geoffrey <gmcalmond@townofware.com>
Subject: RE: Vehicle Inventory

W1: 2020 Ford F-250, 1FTBF2B65LEC49437, 12980 miles
W2: 2022 Ford F-250, 1FDBF2B63BEC00364, 12031 miles
W3: 2018 Ford F-250, 1FD7X2B61JEB76031, 39804 miles

TOWN OF WARE - REAL PROPERTY

Address Number	Address Street	Parcel ID #	Account Number	Current Deed Volume	Current Deed Page	Deed Date	Property and/or Structure Type
	Old Gilberville Road	23-0-13	722				Water Tank
	Anderson Road	15-0-5	314	1260	374	11/5/1957	Water Tank
72	Gilbertville Road	30-44-1	1159	2163	307	5/29/1980	Well 5 & Pump Station
4.5	Church Street	61-0-331	3563				Garage/Office
22	Barnes Street	60-0-70	3271			1886(?)	Wells 1,2,3,4 ,2R, 3R, Cistern, Pump House
	Pleasant Street	62-0-44	3682				
	Pleasant Street	62-0-45	3683				
	Pleasant Street	60-0-177	3150	884	283	12/20/1932	
116	Pleasant Street	60-0-71	3272	13096	66	10/5/2018	House
							TOTAL ACRES WATER
30	Robbins Road	17-0-26	376				Sewer Treatment
							TOTAL ACRES SEWER

Rev. 4/6/23

EXHIBIT # 5

Water Enterprise - Long Term Debt

Issuance Date	Issuer	Project	Outstanding Principal 06/30/22	Outstanding Interest 06/30/22	Date of Maturity
04/13/17	US Bank	Water Main-Richfield Ave	100,000.00	9,000.00	04/13/27
06/17/21	US Bank	Chlor/Corr Facility(original issue date 03/2008)	237,791.00	36,605.94	06/17/28
06/17/21	US Bank	PWED-Water (original issue date 03/2008)	46,033.00	7,351.98	06/17/28
06/17/21	Easthampton Savings Bank*	Water Treatment Plant	220,000.00	1,925.00	06/17/26

Sewer Enterprise - Long Term Debt

Issuance Date	Issuer	Project	Outstanding Principal 06/30/22	Outstanding Interest 06/30/22	Date of Maturity
05/15/14	US Bank	WWTP-Influent Pump Upgrade	20,000.00	1,412.50	05/15/26
05/15/14	US Bank	WWTP-Eng Plan	130,000.00	14,500.00	05/15/29
06/20/19	Easthampton Savings Bank*	Infiltration/Inflow Study - WWTP	50,000.00	925.00	06/20/23
06/20/19	Easthampton Savings Bank*	Infiltration/Inflow Study - WWTP- Phase 2	40,299.00	1,117.36	06/20/24
06/17/21	US Bank	Replace/Reline Sewer Mains	186,300.00	46,207.74	06/17/41
06/17/21	US Bank	PWED-Sewer (original issue datet 03/2008)	9,429.00	1,505.76	06/17/28

*Debt through Easthampton Savings Bank are refunding notes - interest is estimated

Town of Ware

Trial Balance by Fund

Fiscal Year: 2019-2020

From Date: 7/1/2019 To Date: 6/30/2020

6500 - WATER ENTERPRISE FUND		Opening Balance	Debits	Credits	Ending Balance
ASSET					
6500.000.1040.000	WATER ENTERPRISE CASH	$1,642,552.21	$0.00	($122,902.22)	$1,519,649.99
6500.000.1310.000	WATER USER CHARGES RECEIVABLE	$112,370.39	$1,157,511.07	($1,144,538.24)	$125,343.22
6500.000.1311.000	WATER OTHER RECEIVABLE	$737.40	$4,917.97	($5,150.37)	$505.00
6500.000.1330.000	WATER LIENS RECEIVABLE	$26,174.39	$85,780.15	($84,235.19)	$27,719.35
6500.000.1600.000	WATER ENTERPRISE DUE FR G/F	$446.22	$1,606,831.94	($1,605,959.37)	$1,318.79
ASSET TOTAL		$1,782,280.61	$2,855,041.13	($2,962,785.39)	$1,674,536.35
LIABILITY					
6500.000.2001.000	WATER ENTERPRISE BOND ANT NOTES PAYABLE	($311,000.00)	$311,000.00	($335,000.00)	($335,000.00)
6500.000.2010.000	WATER ENTERPRISE WARRANTS PAY	($13,624.03)	$1,084,268.84	($1,141,756.24)	($71,111.43)
6500.000.2011.000	WATER ENTERPRISE ACCRUED PAYABLES	($6,082.56)	$6,082.56	($2,385.34)	($2,385.34)
6500.000.2110.000	WATER ENTERPRISE ACCRUED PAYROLL	($7,854.64)	$7,854.64	($7,501.15)	($7,501.15)
6500.000.2610.000	DEFERRED REVENUE-WATER	($113,107.79)	$1,140,196.60	($1,152,937.03)	($125,848.22)
6500.000.2630.000	DEFERRED REVENUE-WATER LIENS	($26,174.39)	$84,235.19	($85,780.15)	($27,719.35)
LIABILITY TOTAL		($477,843.41)	$2,633,637.83	($2,725,359.91)	($569,565.49)
FUND BALANCE					
6500.000.3510.000	WATER ENTERPRISE F/B RESV FOR ENCUMBRANCES	$261,431.91	$261,431.91	($550,818.32)	($27,954.50)

Trial Balance by Fund

Fiscal Year: 2019-2020

From Date: 7/1/2019 To Date: 6/30/2020

6500 - WATER ENTERPRISE FUND		Opening Balance	Debits	Credits	Ending Balance
6500.000.3530.000	WATER ENTERPRISE F/B RESV FOR SUBSEQUENT YRS	$85,000.00	$85,000.00	($230,000.00)	($60,000.00)
6500.000.3590.000	WATER ENTERPRISE FUND BALANCE	($1,650,869.11)	$780,818.32	($346,431.91)	($1,216,482.70)
FUND BALANCE TOTAL		($1,304,437.20)	$1,127,250.23	($1,127,250.23)	($1,304,437.20)
REVENUE					
6500.000.4142.000	WATER LIEN REVENUE	$0.00	$523.79	($79,774.84)	($79,251.05)
6500.000.4171.000	PENALTIES & INTEREST WATER USER CHARGES	$0.00	$521.74	($19,171.53)	($18,649.79)
6500.000.4210.000	WATER USAGE CHARGES	$0.00	$11,578.07	($988,026.34)	($976,448.27)
6500.000.4800.000	WATER ENTERPRISE MISC INC	$0.00	$0.00	($5,050.00)	($5,050.00)
6500.000.4820.000	WATER ENTERPRISE INTEREST INCOME	$0.00	$0.00	($11,096.54)	($11,096.54)
6500.000.4900.000	WATER ENTERPRISE TRANSFERS IN	$0.00	$0.00	($23,325.00)	($23,325.00)
REVENUE TOTAL		$0.00	$12,623.60	($1,126,444.25)	($1,113,820.65)
EXPENDITURE					
6500.000.5100.000	WATER ENTERPRISE SALARIES	$0.00	$264,229.72	($3,300.46)	$260,929.26
6500.000.5150.000	WATER ENTERPRISE SALARIES-OT	$0.00	$25,220.31	($113.55)	$25,106.76
6500.000.5180.000	WATER ENTERPRISE LICENSES	$0.00	$647.96	$0.00	$647.96
6500.000.5190.000	WATER ENTERPRISE CLOTHING ALLOWANCE	$0.00	$1,528.72	$0.00	$1,528.72
6500.000.5200.000	WATER ENTERPRISE PURCHASE OF SERVICES	$0.00	$229,344.02	($3,526.82)	$225,817.20

Trial Balance by Fund

Fiscal Year: 2019-2020

From Date: 7/1/2019 To Date: 6/30/2020

6500 - WATER ENTERPRISE FUND		Opening Balance	Debits	Credits	Ending Balance
6500.000.5400.000	WATER ENTERPRISE SUPPLIES	$0.00	$182,633.27	($2,290.15)	$180,343.12
6500.000.5700.000	WATER ENTERPRISE OTHER CHARGES	$0.00	$2,725.40	$0.00	$2,725.40
6500.000.5800.000	WATER ENTERPRISE CAPITAL OUTLAY	$0.00	$58,110.00	$0.00	$58,110.00
6500.000.5810.000	WATER ENTERPRISE REPLACE/REDEVELOP WELLS	$0.00	$19,586.00	$0.00	$19,586.00
6500.000.5820.000	WATER ENTERPRISE MAIN/LINE REPLACEMENT	$0.00	$230,265.18	$0.00	$230,265.18
6500.000.5840.000	WATER ENTERPRISE BARNES ST PIPE PROJ	$0.00	$85,000.00	($815.59)	$84,184.41
6500.000.5870.000	WATER ENTERPRISE TREATMENT PLANT	$0.00	$8,484.74	$0.00	$8,484.74
6500.000.5900.000	WATER ENTERPRISE TRANSFERS OUT	$0.00	$215,558.24	$0.00	$215,558.24
EXPENDITURE TOTAL		$0.00	$1,323,333.56	($10,046.57)	$1,313,286.99
Fund Totals:		$0.00	$7,951,886.35	($7,951,886.35)	$0.00

Trial Balance by Fund

Fiscal Year: 2019-2020

From Date: 7/1/2019 To Date: 6/30/2020

	Grand Total:	$0.00	$7,951,886.35	($7,951,886.35)	$0.00

End of Report

Town of Ware

Trial Balance by Fund

Fiscal Year: 2019-2020

From Date: 7/1/2019 To Date: 6/30/2020

6600 - SEWER ENTERPRISE FUND		Opening Balance	Debits	Credits	Ending Balance
ASSET					
6600.000.1040.000	SEWER ENTERPRISE CASH	$490,680.17	$0.00	($364,762.66)	$125,917.51
6600.000.1310.000	SEWER USER CHARGES RECEIVABLE	$96,933.79	$907,133.82	($896,916.82)	$107,150.79
6600.000.1311.000	SEWER OTHER RECEIVABLE	$0.00	$30,156.60	($20,706.60)	$9,450.00
6600.000.1330.000	SEWER LIENS RECEIVABLE	$22,824.62	$72,145.72	($78,797.73)	$16,172.61
6600.000.1600.000	SEWER ENTERPRISE DUE FR G/F	($445.22)	$1,488,606.56	($1,498,312.73)	($10,151.39)
ASSET TOTAL		$609,993.36	$2,498,042.70	($2,859,496.54)	$248,539.52
LIABILITY					
6600.000.2001.000	SEWER ENTERPRISE BOND ANT NOTES PAY	$0.00	$0.00	($200,000.00)	($200,000.00)
6600.000.2010.000	SEWER ENTERPRISE WARRANTS PAY	($53,957.81)	$970,003.42	($945,014.50)	($28,968.89)
6600.000.2011.000	SEWER ENTERPRISE ACCRUED PAYABLES	($32,003.11)	$32,003.11	($21,014.85)	($21,014.85)
6600.000.2110.000	SEWER ENTERPRISE ACCRUED PAYROLL	($11,099.90)	$11,099.90	($6,717.08)	($6,717.08)
6600.000.2610.000	DEFERRED REVENUE-SEWER	($96,933.79)	$901,821.51	($921,488.51)	($116,600.79)
6600.000.2630.000	DEFERRED REVENUE-SEWER LIENS	($22,824.62)	$78,797.73	($72,145.72)	($16,172.61)
LIABILITY TOTAL		($216,819.23)	$1,993,725.67	($2,166,380.66)	($389,474.22)
FUND BALANCE					
6600.000.3510.000	SEWER ENTERPRISE F/B RESV FOR ENCUMBRANCES	$257,961.00	$257,961.00	($521,522.00)	($5,600.00)

Trial Balance by Fund

Fiscal Year: 2019-2020

From Date: 7/1/2019 To Date: 6/30/2020

6600 - SEWER ENTERPRISE FUND		Opening Balance	Debits	Credits	Ending Balance
6600.000.3530.000	SEWER ENTERPRISE RESERVED FOR SUBSEQUENT YRS	$0.00	$0.00	($30,000.00)	($30,000.00)
6600.000.3590.000	SEWER ENTERPRISE FUND BALANCE	($651,135.13)	$551,522.00	($257,961.00)	($357,574.13)
FUND BALANCE TOTAL		($393,174.13)	$809,483.00	($809,483.00)	($393,174.13)
REVENUE					
6600.000.4142.000	SEWER LIEN REVENUE	$0.00	$272.71	($74,129.47)	($73,856.76)
6600.000.4171.000	PENALTIES & INTEREST SEWER USER CHARGES	$0.00	$167.19	($13,644.72)	($13,477.53)
6600.000.4210.000	SEWER USAGE CHARGES	$0.00	$1,019.25	($771,037.40)	($770,018.15)
6600.000.4800.000	SEWER ENTERPRISE MISC INC	$0.00	$0.00	($2,480.00)	($2,480.00)
6600.000.4820.000	SEWER ENTERPRISE INTEREST INCOME	$0.00	$1,093.14	($2,542.30)	($1,449.16)
6600.000.4900.000	SEWER ENTERPRISE TRANSFERS IN	$0.00	$10,097.00	($23,489.00)	($13,392.00)
REVENUE TOTAL		$0.00	$12,649.29	($887,322.89)	($874,673.60)
EXPENDITURE					
6600.000.5100.000	SEWER ENTERPRISE SALARIES	$0.00	$244,567.44	($5,395.42)	$239,172.02
6600.000.5150.000	SEWER ENTERPRISE SALARIES-OT	$0.00	$30,863.23	($302.16)	$30,561.07
6600.000.5180.000	SEWER ENTERPRISE LICENSES	$0.00	$235.98	$0.00	$235.98
6600.000.5190.000	SEWER ENTERPRISE CLOTHING ALLOWANCE	$0.00	$1,765.78	($69.99)	$1,695.79
6600.000.5200.000	SEWER ENTERPRISE PURCHASE OF SERVICES	$0.00	$342,956.01	($20,849.64)	$322,106.37

Trial Balance by Fund

Fiscal Year: 2019-2020

From Date: 7/1/2019 To Date: 6/30/2020

6600 - SEWER ENTERPRISE FUND		Opening Balance	Debits	Credits	Ending Balance
6600.000.5400.000	SEWER ENTERPRISE SUPPLIES	$0.00	$147,905.56	($1,445.50)	$146,460.06
6600.000.5700.000	SEWER ENTERPRISE OTHER CHARGES	$0.00	$1,752.95	($370.00)	$1,382.95
6600.000.5802.000	SEWER ENTERPRISE MAIN/LINE REPLACEMENT	$0.00	$179,687.70	($1,740.00)	$177,947.70
6600.000.5820.000	SEWER INFILTRATION/INFLOW STUDY	$0.00	$22,077.88	($9,308.99)	$12,768.89
6600.000.5840.000	SEWER ENTERPRISE REMOVE SOLIDS FR BASIN	$0.00	$244,184.72	($4,439.00)	$239,745.72
6600.000.5900.000	SEWER ENTERPRISE TRANSFERS OUT	$0.00	$236,705.88	$0.00	$236,705.88
EXPENDITURE TOTAL		$0.00	$1,452,703.13	($43,920.70)	$1,408,782.43
Fund Totals:		$0.00	$6,766,603.79	($6,766,603.79)	$0.00

Trial Balance by Fund

Fiscal Year: 2019-2020

From Date: 7/1/2019 To Date: 6/30/2020

	Grand Total:	$0.00	$6,766,603.79	($6,766,603.79)	$0.00

End of Report

Town of Ware

Trial Balance by Fund

Fiscal Year: 2020-2021

From Date: 7/1/2020 To Date: 6/30/2021

6500 - WATER ENTERPRISE FUND		Opening Balance	Debits	Credits	Ending Balance
ASSET					
6500.000.1040.000	WATER ENTERPRISE CASH	$1,519,649.99	$206,871.27	$0.00	$1,726,521.26
6500.000.1310.000	WATER USER CHARGES RECEIVABLE	$125,343.22	$1,252,683.63	($1,268,324.53)	$109,702.32
6500.000.1311.000	WATER OTHER RECEIVABLE	$505.00	$5,050.00	($4,985.00)	$570.00
6500.000.1330.000	WATER LIENS RECEIVABLE	$27,719.35	$87,125.53	($102,786.29)	$12,058.59
6500.000.1600.000	WATER ENTERPRISE DUE FR G/F	$1,318.79	$1,668,327.99	($1,669,646.78)	$0.00
ASSET TOTAL		$1,674,536.35	$3,220,058.42	($3,045,742.60)	$1,848,852.17
LIABILITY					
6500.000.2001.000	WATER ENTERPRISE BOND ANT NOTES PAYABLE	($335,000.00)	$335,000.00	$0.00	$0.00
6500.000.2010.000	WATER ENTERPRISE WARRANTS PAY	($71,111.43)	$914,888.67	($854,602.56)	($10,825.32)
6500.000.2011.000	WATER ENTERPRISE ACCRUED PAYABLES	($2,385.34)	$2,385.34	($108.50)	($108.50)
6500.000.2110.000	WATER ENTERPRISE ACCRUED PAYROLL	($7,501.15)	$7,501.15	($9,096.52)	($9,096.52)
6500.000.2610.000	DEFERRED REVENUE-WATER	($125,848.22)	$1,271,835.65	($1,256,259.75)	($110,272.32)
6500.000.2630.000	DEFERRED REVENUE-WATER LIENS	($27,719.35)	$102,786.29	($87,125.53)	($12,058.59)
LIABILITY TOTAL		($569,565.49)	$2,634,397.10	($2,207,192.86)	($142,361.25)
FUND BALANCE					
6500.000.3510.000	WATER ENTERPRISE F/B RESV FOR ENCUMBRANCES	($27,954.50)	$27,954.50	($52,540.50)	($52,540.50)

Trial Balance by Fund

Fiscal Year: 2020-2021

From Date: 7/1/2020 To Date: 6/30/2021

6500 - WATER ENTERPRISE FUND		Opening Balance	Debits	Credits	Ending Balance
6500.000.3530.000	WATER ENTERPRISE F/B RESV FOR SUBSEQUENT YRS	($60,000.00)	$60,000.00	($50,000.00)	($50,000.00)
6500.000.3590.000	WATER ENTERPRISE FUND BALANCE	($1,017,016.36)	$102,540.50	($87,954.50)	($1,002,430.36)
FUND BALANCE TOTAL		($1,104,970.86)	$190,495.00	($190,495.00)	($1,104,970.86)
REVENUE					
6500.000.4142.000	WATER LIEN REVENUE	$0.00	$268.90	($97,921.18)	($97,652.28)
6500.000.4170.000	PENALTIES & INTEREST WATER LIENS	$0.00	$61.99	($61.99)	$0.00
6500.000.4171.000	PENALTIES & INTEREST WATER USER CHARGES	$0.00	$238.31	($22,487.29)	($22,248.98)
6500.000.4210.000	WATER USAGE CHARGES	$0.00	$10,008.85	($1,183,677.81)	($1,173,668.96)
6500.000.4800.000	WATER ENTERPRISE MISC INC	$0.00	($37.00)	($342.77)	($379.77)
6500.000.4820.000	WATER ENTERPRISE INTEREST INCOME	$0.00	$0.00	($4,033.64)	($4,033.64)
6500.000.4900.000	WATER ENTERPRISE TRANSFERS IN	$0.00	$0.00	($22,263.00)	($22,263.00)
6500.000.4990.000	WATER ENTERPRISE NOTE PROCEEDS	$0.00	$0.00	($335,000.00)	($335,000.00)
REVENUE TOTAL		$0.00	$10,541.05	($1,665,787.68)	($1,655,246.63)
EXPENDITURE					
6500.000.5100.000	WATER ENTERPRISE SALARIES	$0.00	$260,278.02	($2,007.70)	$258,270.32
6500.000.5150.000	WATER ENTERPRISE SALARIES-OT	$0.00	$32,878.46	($347.17)	$32,531.29
6500.000.5180.000	WATER ENTERPRISE LICENSES	$0.00	$102.00	$0.00	$102.00

Trial Balance by Fund

Fiscal Year: 2020-2021

From Date: 7/1/2020 To Date: 6/30/2021

6500 - WATER ENTERPRISE FUND		Opening Balance	Debits	Credits	Ending Balance
6500.000.5190.000	WATER ENTERPRISE CLOTHING ALLOWANCE	$0.00	$1,503.72	$0.00	$1,503.72
6500.000.5200.000	WATER ENTERPRISE PURCHASE OF SERVICES	$0.00	$234,062.25	($1,397.14)	$232,665.11
6500.000.5202.000	WATER ENTERPRISE INSPECT/CLEAN WATER TANKS	$0.00	$10,000.00	$0.00	$10,000.00
6500.000.5400.000	WATER ENTERPRISE SUPPLIES	$0.00	$187,628.52	($3,013.92)	$184,614.60
6500.000.5700.000	WATER ENTERPRISE OTHER CHARGES	$0.00	$2,200.00	$0.00	$2,200.00
6500.000.5800.000	WATER ENTERPRISE CAPITAL OUTLAY	$0.00	$17,000.00	$0.00	$17,000.00
6500.000.5805.000	WATER ENTERPRISE METERS/SOFTWARE	$0.00	$50,000.00	$0.00	$50,000.00
6500.000.5870.000	WATER ENTERPRISE TREATMENT PLANT	$0.00	$18,879.10	($2,642.44)	$16,236.66
6500.000.5900.000	WATER ENTERPRISE TRANSFERS OUT	$0.00	$248,602.87	$0.00	$248,602.87
EXPENDITURE TOTAL		$0.00	$1,063,134.94	($9,408.37)	$1,053,726.57
Fund Totals:		$0.00	$7,118,626.51	($7,118,626.51)	$0.00

Trial Balance by Fund

Fiscal Year: 2020-2021

From Date: 7/1/2020 To Date: 6/30/2021

Grand Total:		$0.00	$7,118,626.51	($7,118,626.51)	$0.00

End of Report

Town of Ware

Trial Balance by Fund

Fiscal Year: 2020-2021

From Date: 7/1/2020 To Date: 6/30/2021

6600 - SEWER ENTERPRISE FUND		Opening Balance	Debits	Credits	Ending Balance
ASSET					
6600.000.1040.000	SEWER ENTERPRISE CASH	$125,917.51	$0.00	($55,023.93)	$70,893.58
6600.000.1310.000	SEWER USER CHARGES RECEIVABLE	$107,150.79	$889,621.50	($913,580.64)	$83,191.65
6600.000.1311.000	SEWER OTHER RECEIVABLE	$9,450.00	$32,959.48	($31,749.48)	$10,660.00
6600.000.1330.000	SEWER LIENS RECEIVABLE	$16,172.61	$71,158.19	($78,076.07)	$9,254.73
6600.000.1600.000	SEWER ENTERPRISE DUE FR G/F	($10,151.39)	$1,240,992.70	($1,230,841.31)	$0.00
ASSET TOTAL		$248,539.52	$2,234,731.87	($2,309,271.43)	$173,999.96
LIABILITY					
6600.000.2001.000	SEWER ENTERPRISE BOND ANT NOTES PAY	($200,000.00)	$200,000.00	$0.00	$0.00
6600.000.2010.000	SEWER ENTERPRISE WARRANTS PAY	($28,968.89)	$743,772.37	($732,051.13)	($17,247.65)
6600.000.2011.000	SEWER ENTERPRISE ACCRUED PAYABLES	($21,014.85)	$21,756.92	$0.00	$742.07
6600.000.2110.000	SEWER ENTERPRISE ACCRUED PAYROLL	($6,717.08)	$6,717.08	($7,443.56)	($7,443.56)
6600.000.2610.000	DEFERRED REVENUE-SEWER	($116,600.79)	$943,031.64	($920,282.50)	($93,851.65)
6600.000.2630.000	DEFERRED REVENUE-SEWER LIENS	($16,172.61)	$78,076.07	($71,158.19)	($9,254.73)
LIABILITY TOTAL		($389,474.22)	$1,993,354.08	($1,730,935.38)	($127,055.52)
FUND BALANCE					
6600.000.3510.000	SEWER ENTERPRISE F/B RESV FOR ENCUMBRANCES	($5,600.00)	$5,600.00	$0.00	$0.00

Trial Balance by Fund

Fiscal Year: 2020-2021

From Date: 7/1/2020 To Date: 6/30/2021

6600 - SEWER ENTERPRISE FUND		Opening Balance	Debits	Credits	Ending Balance
6600.000.3530.000	SEWER ENTERPRISE RESERVED FOR SUBSEQUENT YRS	($30,000.00)	$30,000.00	$0.00	$0.00
6600.000.3590.000	SEWER ENTERPRISE FUND BALANCE	$176,534.70	$0.00	($35,600.00)	$140,934.70
FUND BALANCE TOTAL		$140,934.70	$35,600.00	($35,600.00)	$140,934.70
REVENUE					
6600.000.4142.000	SEWER LIEN REVENUE	$0.00	$917.11	($80,373.00)	($79,455.89)
6600.000.4171.000	PENALTIES & INTEREST SEWER USER CHARGES	$0.00	$17.31	($16,341.01)	($16,323.70)
6600.000.4210.000	SEWER USAGE CHARGES	$0.00	$591.45	($871,508.09)	($870,916.64)
6600.000.4820.000	SEWER ENTERPRISE INTEREST INCOME	$0.00	$15.20	($65.74)	($50.54)
6600.000.4900.000	SEWER ENTERPRISE TRANSFERS IN	$0.00	$0.00	($10,171.00)	($10,171.00)
6600.000.4990.000	SEWER ENTERPRISE BOND PROCEEDS	$0.00	$0.00	($200,000.00)	($200,000.00)
REVENUE TOTAL		$0.00	$1,541.07	($1,178,458.84)	($1,176,917.77)
EXPENDITURE					
6600.000.5100.000	SEWER ENTERPRISE SALARIES	$0.00	$221,135.23	($1,715.24)	$219,419.99
6600.000.5150.000	SEWER ENTERPRISE SALARIES-OT	$0.00	$27,039.79	($436.43)	$26,603.36
6600.000.5180.000	SEWER ENTERPRISE LICENSES	$0.00	$200.00	$0.00	$200.00
6600.000.5190.000	SEWER ENTERPRISE CLOTHING ALLOWANCE	$0.00	$1,539.95	$0.00	$1,539.95
6600.000.5200.000	SEWER ENTERPRISE PURCHASE OF SERVICES	$0.00	$370,241.74	($23,617.65)	$346,624.09

Trial Balance by Fund

Fiscal Year: 2020-2021

From Date: 7/1/2020 To Date: 6/30/2021

6600 - SEWER ENTERPRISE FUND		Opening Balance	Debits	Credits	Ending Balance
6600.000.5400.000	SEWER ENTERPRISE SUPPLIES	$0.00	$150,390.53	($1,848.83)	$148,541.70
6600.000.5700.000	SEWER ENTERPRISE OTHER CHARGES	$0.00	$506.00	$0.00	$506.00
6600.000.5802.000	SEWER ENTERPRISE MAIN/LINE REPLACEMENT	$0.00	$5,555.00	($3,575.00)	$1,980.00
6600.000.5900.000	SEWER ENTERPRISE TRANSFERS OUT	$0.00	$238,297.56	$0.00	$238,297.56
6600.000.6200.000	SEWER ENTERPRISE ENC PURCH OF SVCS	$0.00	$5,325.98	$0.00	$5,325.98
EXPENDITURE TOTAL		$0.00	$1,020,231.78	($31,193.15)	$989,038.63
Fund Totals:		$0.00	$5,285,458.80	($5,285,458.80)	$0.00

Trial Balance by Fund

Fiscal Year: 2020-2021

From Date: 7/1/2020 To Date: 6/30/2021

Grand Total:		$0.00	$5,285,458.80	($5,285,458.80)	$0.00

End of Report

Water
Indirect Costs - Estimates for FY22

	FY21	FY22
Health Insurance	54,089.00	42,143.56
Medicare	4,504.00	4,497 97
Retirement	86,832.00	89,765.16
Administration	10,863.00	11,014.83
Fuel	5,000.00	5,000.00
Principal & Interest	163,513.00	128,854.13
Mowing	7,875.00	7,875 00
Collections	17,145.00	17,612.50
Retirees Health Insurance	9,702.00	10,353 75
Sick Leave Buyback	-	-
Credits to System	(34,400.00)	(34,400 00)
	325,123 00	282,716 90

Sewer
Indirect Costs - Estimates for FY22

	FY21	FY22
Health Insurance	62,540.00	56,802.03
Medicare	3,976.00	3,549.43
Retirement	69,100.00	68,808.66
Administration	11,625.00	11,512.95
Fuel	1,400.00	1,400.00
Retirees Health Insurance	8,125.00	8,739.88
Principal & Interest	112,828.00	97,064.04
	269,594.00	247,877.00

EXHIBIT # 6

FY24 Actual versus Budget YTD - Water

Account Number	Account	YTD Budget	YTD Actual	Remaining Budget $	Remaining Budget %
5100	Salaries	$ 316,055.00	$ -	$ 316,055.00	100.00%
5150	Overtime	$ 42,000.00	$ -	$ 42,000.00	100.00%
5180	Licenses	$ 850.00	$ -	$ 850.00	100.00%
5190	Clothing Allowance	$ 2,000.00	$ -	$ 2,000.00	100.00%
5200	Purchase of Services	$ 233,000.00	$ -	$ 233,000.00	100.00%
5400	Supplies	$ 234,000.00	$ -	$ 234,000.00	100.00%
5700	Other Charges	$ 2,600.00	$ -	$ 2,600.00	100.00%
5850	Extraordinary/Unforseen	$ 10,000.00	$ -	$ 10,000.00	100.00%
5800	Capital Outlay	$ 100,000.00	$ -	$ 100,000.00	100.00%
				$ -	
Total		**$ 940,505.00**	**$ -**	**$ 940,505.00**	**100.00%**

FY24 Sewer Actual versus Budget YTD

Account Number	Account	YTD Budget	YTD Actual	Remaining Budget $	Remaining Budget %	Column1
	5100 Salaries	$ 250,636.00	$0.00	$ 250,636.00	100.00%	
	5150 Overtime	$ 25,000.00	$ -	$ 25,000.00	100.00%	
	5180 Licenses	$ 800.00	$ -	$ 800.00	100.00%	
	5190 Clothing Allowance	$ 1,500.00	$ -	$ 1,500.00	100.00%	
	5200 Purchase of Services	$ 470,000.00	$ -	$ 470,000.00	100.00%	
	5400 Supplies	$ 180,000.00	$ -	$ 180,000.00	100.00%	
	5700 Other Charges	$ 1,750.00	$ -	$ 1,750.00	100.00%	
	5800 Capital Outlay	$ -	$ -	$ -	#DIV/0!	
	5850 Extraordinary/Unforeseen	$ 10,000.00	$ -	$ 10,000.00	100.00%	
Total		$ 939,686.00	$ -	$ 939,686.00	100.00%	
		$ -	$ -	$ -	#DIV/0!	
		$ -	$ -	$ -	#DIV/0!	
Total						

EXHIBIT # 7

Ware Water System
Water Rate Evaluation

TO: Stuart Beckley, Town Administrator, Town of Ware
Gibby St. George-Sorel, DPW Director, Town of Ware
Andy Lalashius, Water Supervisor, Town of Ware

FROM: Michael J. Schrader, PE, Principal Engineer, Tighe & Bond

COPY: Jeff Faulkner PE, Senior Project Manager, Tighe & Bond

DATE: February 2, 2021

1 Background

The Town of Ware owns and operates a public water system to provide drinking water to its residents and businesses. The water system is managed as an enterprise fund, which is an accounting (best) practice defined in Massachusetts General Law (MGL) c. 44, § 53F½, Enterprise funds provide financial separation between a utility and the municipality's General Fund by segregating the costs and revenue associated with the utility from the rest of the Town's budget. The utility related costs are then recovered from the utility's customers in the form of water and/or sewer bills.

The Ware water system provide services to about 2,350 user accounts and like most towns, Ware's customer base is predominately residential (92% by count, 65% by usage), this represents about 70% of the residential parcels in Town.

Ware's existing water rate structure consists of a base charge and a uniform usage charge, both are applied equally to all customers and all usage values. In terms of peer comparisons, the 2000 Tighe & Bond water rate survey of Massachusetts water suppliers showed that responding water systems were split about 50/50 between tiered and uniform water rates, by 2017 however, the ratio shifted to roughly 70/30 tiered versus uniform rate. Ware issues water bills on a quarterly basis which was 2017's the most common billing frequency (58%) and is appropriate for the size of the Ware water system.

2 Water Usage Evaluation

Seventy percent (70%) of Ware's user charge revenue is related directly to usage while approximately 30% is related to the base charge. Future revenue is estimated based upon projected usage, so it is important to evaluate water use trends. Source data used consists of account level water usage data (customers meters billing data) for calendar years 2016 through 2020 and ASR[1] data.

Figure 1 shows the historic and projected water use. The historic data was adjusted as follows:

Customer data – The water usage data showed that the total usage in Fiscal Year (FY) 19 was twice that of FY18. Closer examination of the customer level water usage data showed that there were three customers with usages that were many orders of magnitude higher than expected. Table 1 shows this data.

[1] Annual Statistical Report (ASR) is a collection of data submitted by every to the Massachusetts Department of Environmental Protection annually.

Table 1

FY19 Water Account Data Anomalies

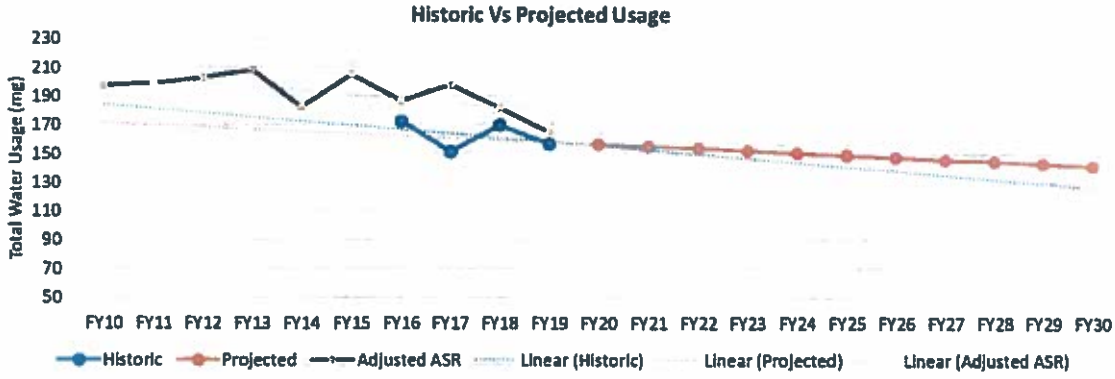
ACCOUNT	SERVICE ADDRESS	Meter Size	WATERUSE	SEWERUSE	water:sewer ratio
02-2520	237 WEST ST - IRRIGATION SYS	3	90,381	9,033,109	100 X
12-2613	4 1/2 CHURCH ST	1	1,877	6,701,722	3,570 X
12-2613	4 1/2 CHURCH ST	1	1,283	3,301,009	2,573 X
02-2520	237 WEST ST - IRRIGATION SYS	3	10,142	1,014,184	100 X

The Town bills sewer usage based upon water usage, therefore the sewer usage values shown in Table 1 represents the unadjusted water use value, the values in the water use column were adjusted by comparing previous water usage for the same billing period.

ASR data was adjusted to Fiscal Year totals by summing monthly usage data which was then adjusted by the amount of Unaccounted for Water (UAW). Note that the 2019 UAW was 21.9% which was nearly twice the average for the previous five years. This may reflect the usage data anomalies described above.

Figure 2

Historic and Projected Water Usage



In reviewing customer water usage data, there appears to be a disparity between the two data sources in FY17, beyond that however there is strong correlation supporting a decline in water use. The data supports a 2.25% annual water usage decrease, however in discussing this with the Town an average decline of 1.0% was used to project water use starting in FY20. This is reflected in the orange line shown in Figure 1 from FY20 to FY30. A potential contributor to the decline in usage may be the due to the impacts of customers getting brown water due to the iron and manganese present in the Town's source water.

The summer to winter ratio[2] is a measure of seasonal increase in water usage. The summer/ winter ratio is influenced by several factors, generally weather is the biggest influencer, however for landlocked communities, this increase is typically due to outdoor irrigation and other discretionary summer water usage. The Town of Ware has an average summer to winter ratio of 1.2, representing a 20% increase in usage during the summer compared to winter months. A summer to winter ratio of 1.2 is similar to other landlocked communities without large seasonal population changes and is considered reasonable.

[2] The Massachusetts Department of Environmental Protection (MassDEP) defines summer as May – September and winter as November to March.

2.1 Water Withdrawal Limits

The Water Management Act (MGL c. 21G) adopted in 1986 regulates the amount of water that may be withdrawn from either surface or groundwater sources. Authorized usage is defined as registered, permitted, or both. Prior to January 1988, systems could establish or "register" their usage based upon their average water use from 1981-1985. Ware has 6 registered drinking water wells from which the Town can withdraw water. The total amount of water that may be withdrawn is defined by the Town's Water Management Act Permit combined with the volume that was registered at the time the Water Management Act was enacted.

Figure 2 shows Ware's actual annual daily average water withdrawal versus authorized annual daily average water withdrawal from 2009 to 2019.

Figure 2

Actual Withdrawal versus Authorized Withdrawals [million gallons per day(mgd)]

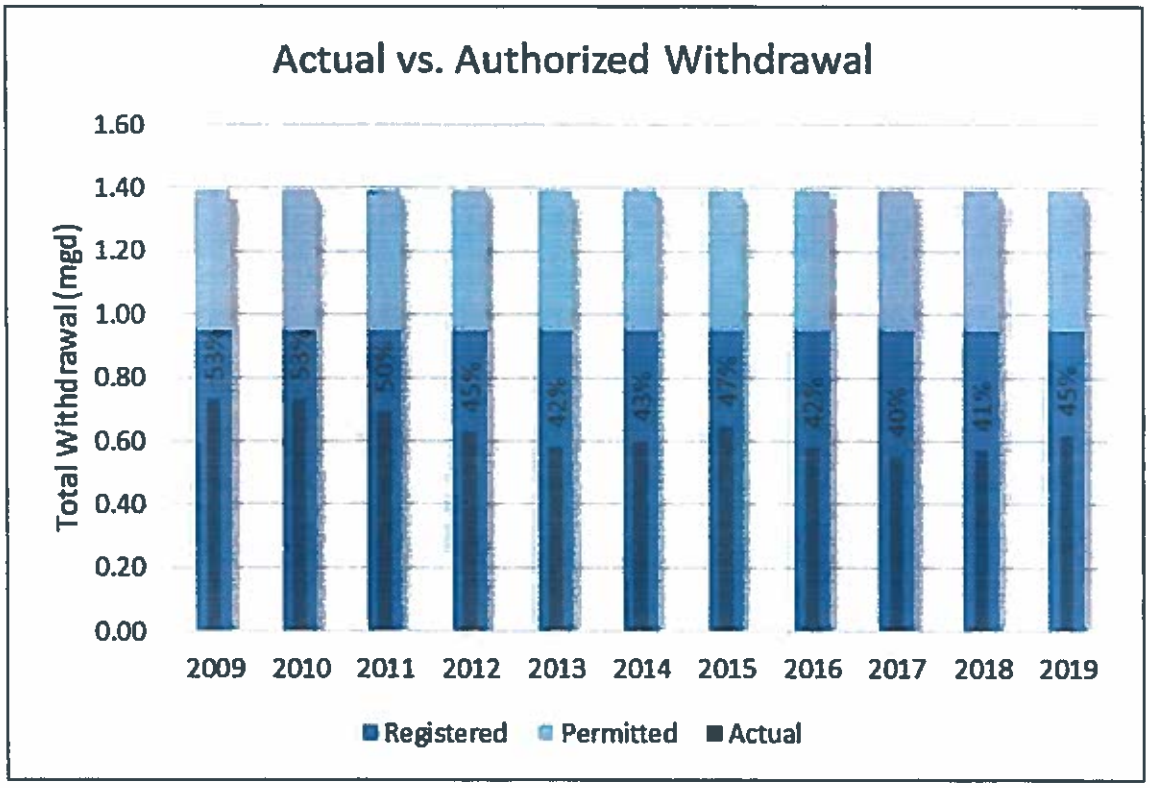


Figure 2 illustrates that the Town's actual water withdrawal has been hovering at less than half of their total water withdrawal capacity since 2012.

Ware's reported residential water use was 40 gallons per person per day in 2019 and averaged 45 over the last ten years which is significantly lower than the MassDEP's target maximum of 65 gallons per person per day. Based upon this, the low seasonal increase and the abundant water supply, there is not a compelling case for increasing water conservation beyond normal prudence.

3 Water Enterprise Fund Expenses

Expenses for a water system consist of operating expenses, debt service, and capital improvements plan costs.

3.1 Operating Expenses

While operating costs can be broken down into fixed (irrespective of water production) or variable (dependent on water volume produced), around 80% of a typical water utility's costs are in fact fixed costs. Table 2 shows a portion of Ware's water rate model dashboard containing the operating expenses.

Table 2

Ware Water Enterprise Operating Expenses

	Budget FY20	Budget FY21	Projected FY22	Projected FY23	Projected FY24	Projected FY25
Operating Expenses						
Salaries & Wages	$290,981	$310,653	$321,526	$332,779	$344,427	$356,481
Supplies	$166,200	$180,300	$186,611	$193,142	$199,902	$206,898
Other Expenses	$244,000	$225,042	$232,918	$391,070	$404,758	$418,924
Indirect Expenses	$102,934	$132,157	$136,782	$141,570	$146,525	$151,653
Subtotal	$804,115	$848,152	$877,837	$1,058,561	$1,095,611	$1,133,957
Delta Previous	$701,181	5.5%	3.5%	20.6%	3.5%	3.5%
Capital Expenses						
Capital Outlay			$0	$22,000	$22,000	$22,000
Existing Debt Service	$0	$113,726	$115,331	$112,059	$108,987	$105,808
New Debt Service	$0	$0	$0	$542,784	$796,476	$921,784
Subtotal	$0	$113,726	$115,331	$676,843	$927,462	$1,049,592
Delta Previous			1.4%	486.9%	37.0%	13.2%
TOTAL EXPENSES	$804,115	$961,878	$993,168	$1,735,404	$2,023,073	$2,183,549
Delta Previous	-3.4%	19.6%	3.3%	74.7%	16.6%	7.9%

FY22 is the first projected year and is based upon the FY21 operating budget and escalated annually by 3.5% to account for future cost increases. The indirect line item represents fringe benefits for employees while other expenses include licenses and purchase of services.

3.2 Capital Improvement Plan (CIP)

The need for capital improvements is by far the single biggest driver behind water rate increases and Ware is no exception. The Capital Improvement Module of the water rate model includes $26,000,000 worth of capital improvement projects that were either taken from the 2016 Water Master Plan prepared by Wright-Pierce or information from the Town.

Table 3

Ware Water Capital Improvement Plan

Capital Improvement Planner

ID	System	Description	Funding source	Interest Rate	Estimated Cost	Cost Year	Escalated Cost	Start Year	Term
1	Treatment	Water Filtration Plant	USDA	1.750%	$13,276,000	2023	$ 13,280,000	2023	40
2	Source	Dismal Swamp Well Generator + Well #4	[illegible]	4.5%	$500,000	2016	$ 620,000	2023	10
3	Distribution	Hydrant Replacement (5 per year)	Rate	–	$175,000	2016	$ 220,000	2023	10
4	Storage	Anderson Road Water Tank Rehabilitation	[illegible]	4.5%	$1,400,000	2020	$ 1,580,000	2024	20
5	Storage	Church St WST Water Tank Rehabilitation	[illegible]	4.5%	$1,400,000	2020	$ 1,630,000	2025	20
6	Distribution	Water Main Replacement #1-12" DI (~3,800LF)	[illegible]	4.5%	$1,520,000	2020	$ 1,720,000	2024	20
7	Distribution	Water Main Replacement #2-8" DI (~5,860LF)	[illegible]	4.5%	$2,000,000	2020	$ 2,390,000	2026	20
8	Distribution	Water Main Replacement #3-8" DI (~5,860LF)	[illegible]	4.5%	$2,100,000	2020	$ 2,670,000	2028	20
			Total		$22,371,000		$ 24,110,000		

The cost of the new filtration plant of about $13,300,000 shown above includes engineering cost and contingency and represents about half of the total CIP costs. The filtration plant is assumed to be funded using a United States Department of Agriculture (USDA) rural development loan with a reduced interest rates of 1.75% and a 40-year loan payback term. The estimated annual debt service for the water filtration plant is $465,000.

The remainder of the projects within the CIP, with the exception of the hydrant replacements, are assumed to be funded through municipal bonds or other debt instruments with an assumed interest rate of 4.5%. These projects were assumed to be debt funded because the individual project costs are the same order of magnitude as the total projected budgets which would require rate increases to be double or more to cover the cost. Additional funding options could be explored by the Town if desired.

4 Water Enterprise Fund Revenue

Revenue for a water enterprise comes primarily from user rates with non-rate revenue coming from liens and penalties due to non-payment of water bills, interest on investments, and miscellaneous fees and charges. About 90% of Ware's water revenue is from user rates and base charges.

4.1 Rate Evaluation

Ware's current water rates consist of a base fee and a usage fee which are billed quarterly. Based upon the results of the usage evaluation and discussion with the Town, the alternatives selected for evaluation were based upon a varying degree of cost share of the anticipated water filtration plant annual debt service ($465,000) from the general fund rather than different water rate structures. The proforma for each alternative is shown below. In each scenario, rates are adjusted to maintain a fund balance of at least 20% of operating costs and to favor multiyear increases over one sudden rate increase.

Due to proactive rate increases in the past few years, the water enterprise has a robust fund balance, therefore all scenarios reflect a combination of balanced rate increases and reserve spend down.

The Alternatives reviewed were:

- Alternative A – Water Filtration Plant 100% Funded by Water Rates with no General Fund Contribution
- Alternative B – Water Filtration Plant 75% Funded by Water Rates and 25% Funded by General Fund Contribution
- Alternative C – Water Filtration Plant 50% Funded by Water Rates and 50% Funded by General Fund Contribution

4.1.1 Alternative A – Water Filtration Plant 100% Funded by Water Rates with no General Fund Contribution

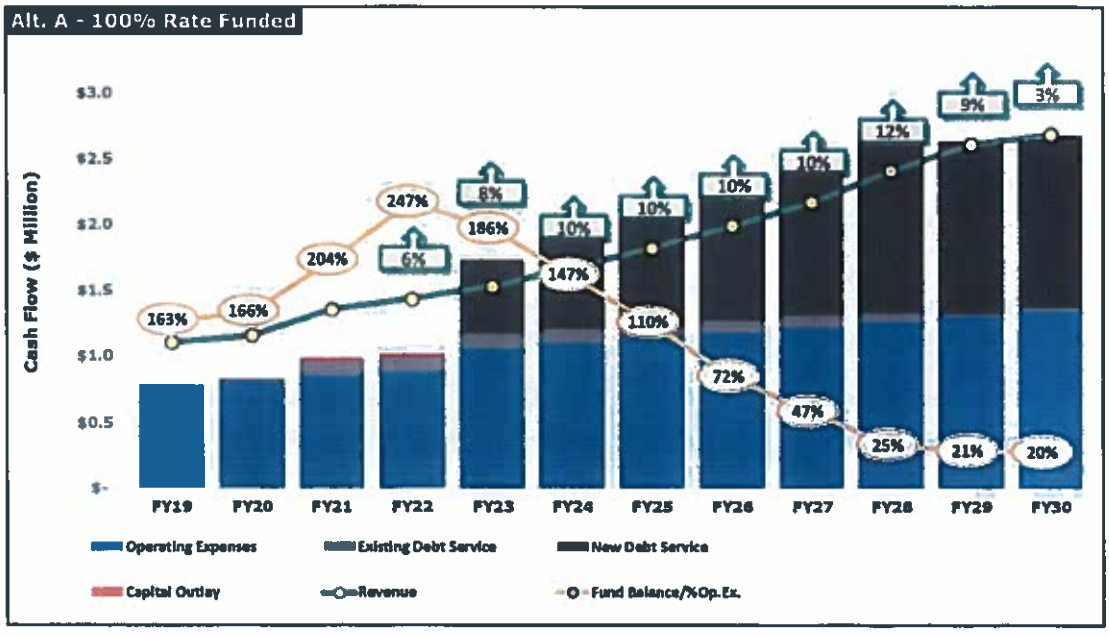
Table 4

Water Rate Model Alterative A – 5 Years of Projected Revenue

	FY20	FY21	FY22	FY23	FY24	FY25
Revenue		*Rate Increase*	6%	8%	10%	10%
Rate Revenue	$ 1,052,917	$ 1,200,123	$ 1,284,347	$ 1,357,201	$ 1,483,918	$ 1,622,538
Non Rate Revenue	$ 102,355	$ 152,941	$ 168,815	$ 175,740	$ 185,753	$ 199,418
Total Revenue	$ 1,155,272	$ 1,353,064	$ 1,453,162	$ 1,532,941	$ 1,669,671	$ 1,821,955
Delta previous (Rate Revenue)		*14.0%*	*5.4%*	*7.3%*	*9.3%*	*9.3%*
Net Revenue	$ 351,157	$ 391,186	$ 439,994	$ (202,463)	$ (353,402)	$ (361,593)
Fund Balance	$1,335,780	$1,726,968	$2,166,960	$1,964,497	$1,611,095	$1,249,502
(as % OpEx)	166%	204%	247%	186%	147%	110%

Figure 3

Water Rate Model Alterative A Proforma



4.1.2 Alternative B – Water Filtration Plant 75% Funded by Water Rates and 25% Funded by General Fund Contribution

Table 5

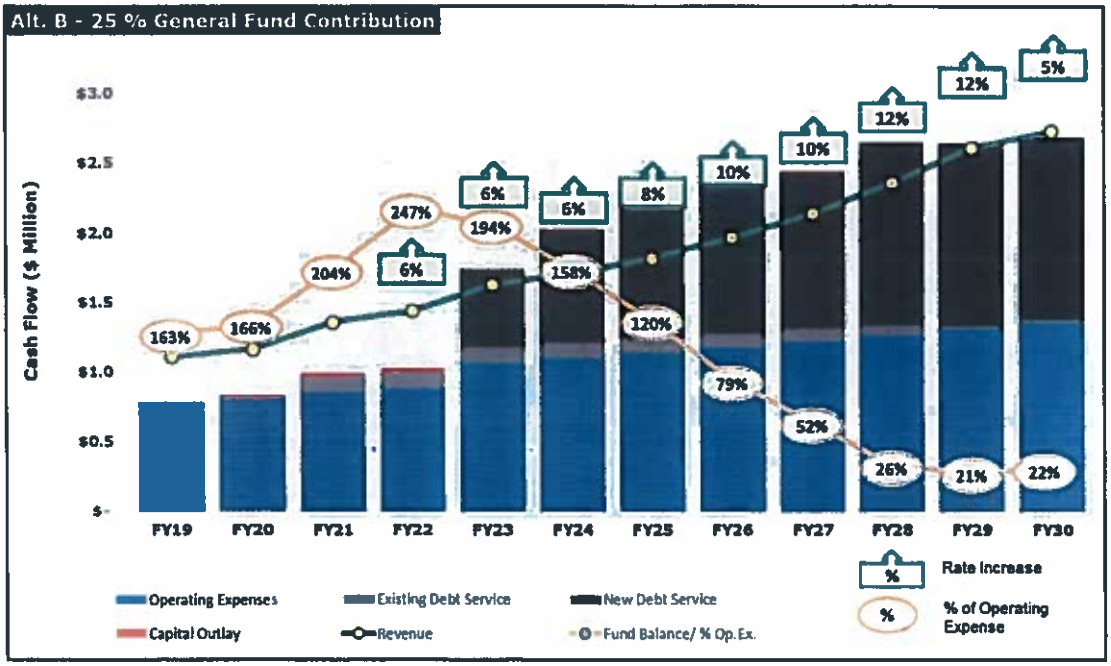
Water Rate Model Alterative B – 5 Years of Projected Revenue

Revenue - Alt. B	FY20	FY21	FY22	FY23	FY24	FY25
			6%	6%	6%	8%
Rate Revenue	$ 1,052,917	$ 1,200,123	$ 1,264,347	$ 1,332,068	$ 1,403,476	$ 1,506,680
Non Rate Revenue	$ 102,355	$ 152,941	$ 168,815	$ 175,740	$ 183,043	$ 190,743
GF Contribution				$ 116,107	$ 116,107	$ 116,107
Total Revenue	$ 1,155,272	$ 1,353,064	$ 1,433,162	$ 1,623,915	$ 1,702,627	$ 1,813,531
delta previous		*$ 147,206*	*$ 64,225*	*$ 67,720*	*$ 71,409*	*$ 103,204*
Grant or GF Subsidy =	*25%*					

Net Revenue (Revenue-Expense)	$ 351,157	$ 391,186	$ 439,994	$ (111,489)	$ (320,446)	$ (370,018)
Retained Earnings Balance	$1,335,780	$1,726,966	$2,166,960	$2,055,471	$1,735,025	$1,365,007
(as % OpEx)	166%	204%	247%	194%	158%	120%

Figure 4

Water Rate Model Alterative B Proforma



4.1.3 Alternative C - Water Filtration Plant 50% Funded by Water Rates and 50% Funded by General Fund Contribution

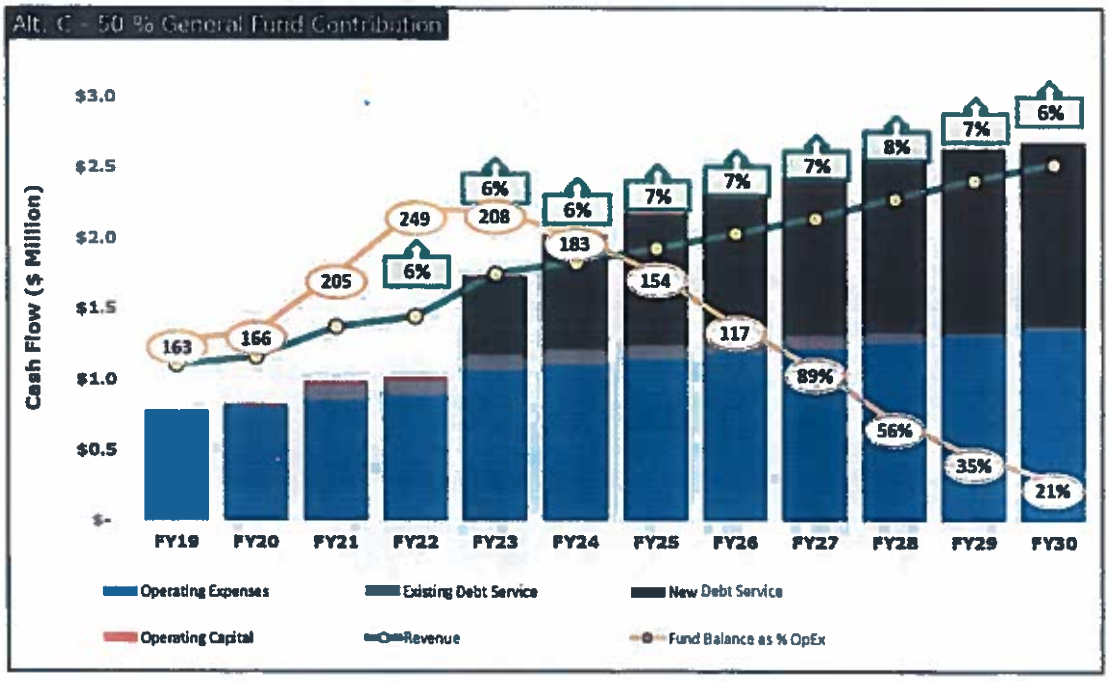
Table 6

Water Rate Model Alterative C – 5 Years of Projected Revenue

Revenue - Alt C	FY20	FY21	FY22	FY23	FY24	FY25
			6%	6%	6%	7%
Total Rate Revenue	$ 1,052,917	$ 1,200,123	$ 1,264,347	$ 1,332,068	$ 1,403,476	$ 1,492,730
Non-Rate Revenue	$ 102,355	$ 168,815	$ 175,740	$ 183,043	$ 190,743	$ 200,368
GF Contribution				$ 232,215	$ 232,215	$ 232,215
Total Revenue	$ 1,155,272	$ 1,368,937	$ 1,440,088	$ 1,747,325	$ 1,826,434	$ 1,925,312
delta previous		*$ 147,206*	*$ 64,225*	*$ 67,720*	*$ 71,409*	*$ 89,253*
Grant or GF Subsidy =	*50%*					
Net Revenue (Revenue-Expense)	$ 351,157	$ 407,060	$ 446,920	$ 11,921	$ (196,639)	$ (258,237)
Retained Earnings Balance	$1,335,780	$1,742,840	$2,189,760	$2,201,681	$2,005,042	$1,748,805
Retained Earnings as Percent of O	166%	205%	249%	208%	183%	154%

Figure 5

Water Rate Model Alterative C Proforma



Note that under this scenario, additional rate increases will be required beyond FY30.

4.1.4 Water Rates

The projected water rates under each scenario are shown below. The "Existing Rate - Do Nothing" scenario is shown only to provide the historic rate increases and is not a viable alternative.

Table 7

Proposed Rate Increases

Existing Rates - Do Nothing

Rate Increase	*Base Charge*	*4%*	*6%*									
	Consumption	*12%*	*10%*									
Description	Type	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Base Charge	Quarterly Fee	$34.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00
Consumption	Usage	$5.20	$5.75	$5.75	$5.75	$5.75	$5.75	$5.75	$5.75	$5.75	$5.75	$5.75

Alt. A - 100% Rate Funded

	Rate Increase			*6%*	*8%*	*10%*	*10%*	*10%*	*10%*	*12%*	*9%*	*3%*
Description	Type	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Base Charge	Quarterly Fee	$34.00	$36.00	$38.16	$41.21	$45.33	$49.87	$54.85	$60.34	$67.58	$73.66	$75.87
Consumption	Usage	$5.20	$5.75	$6.10	$6.59	$7.24	$7.96	$8.76	$9.64	$10.79	$11.77	$12.12

Alt. B - 25 % General Fund Contribution *

	Rate Increase			*6%*	*6%*	*6%*	*8%*	*10%*	*10%*	*12%*	*12%*	*5%*
Description	Type	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Base Charge	Quarterly Fee	$34.00	$36.00	$38.16	$40.45	$42.88	$46.31	$50.94	$56.03	$62.75	$70.29	$73.80
Consumption	Usage	$5.20	$5.75	$6.10	$6.46	$6.85	$7.40	$8.14	$8.95	$10.02	$11.23	$11.79

Alt. C - 50 % General Fund Contribution *

				6%	*6%*	*6%*	*7%*	*7%*	*7%*	*8%*	*7%*	*6%*
Description	Type	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Base Charge	Quarterly Fee	$34.00	$36.00	$38.16	$40.45	$42.88	$45.88	$49.09	$52.53	$56.73	$60.70	$64.34
Consumption	Usage	$5.20	$5.75	$6.10	$6.46	$6.85	$7.33	$7.84	$8.39	$9.06	$9.69	$10.28

5 Cost Impacts & Affordability

When evaluating water rates, the total annual cost for residential users is typically the most important metric for stakeholders. Calculating the cost to a residential user also provides a convenient means to compare different rate alternatives.

5.1 Annual Water Customer and Taxpayer Costs

The costs shown below are based upon a 4-person household using 50 gallons per person per day, which is the usage recommended for evaluating the financial burden. For context, the US Census Bureau reported Ware's average family size to be 2.2 persons per household and 65 gallons per gallon per person per day is the MassDEP's target water conservation goal.

Table 8

Typical Residential Cost

Annual Cost												
Scenario	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
100% Rate Funded	$ 480	$ 531	$ 581	$ 616	$ 665	$ 732	$ 805	$ 885	$ 974	$1,091	$ 1,189	$ 1,224
Increase		*$ 52*	*$ 50*	*$ 35*	*$ 49*	*$ 67*	*$ 73*	*$ 80*	*$ 89*	*$ 117*	*$ 98*	*$ 36*
25% GF Contribution	$ 480	$ 531	$ 581	$ 616	$ 653	$ 692	$ 747	$ 822	$ 904	$1,013	$ 1,134	$ 1,191
Tax Impact					*$ 32*	*$ 32*	*$ 32*	*$ 32*	*$ 32*	*$ 32*	*$ 32*	*$ 32*
Total	$ 480	$ 531	$ 581	$ 616	$ 685	$ 724	$ 779	$ 854	$ 936	$1,045	$ 1,166	$ 1,223
Increase		*$ 52*	*$ 50*	*$ 35*	*$ 69*	*$ 39*	*$ 55*	*$ 75*	*$ 82*	*$ 109*	*$ 122*	*$ 57*
50% GF Contribution	$ 480	$ 531	$ 581	$ 616	$ 653	$ 692	$ 740	$ 792	$ 848	$ 916	$ 980	$ 1,038
Tax Impact					*$ 65*	*$ 65*	*$ 65*	*$ 65*	*$ 65*	*$ 65*	*$ 65*	*$ 65*
	$ 480	*$ 531*	*$ 581*	*$ 616*	*$ 718*	*$ 757*	*$ 805*	*$ 857*	*$ 913*	*$ 981*	*$ 1,045*	*$ 1,103*
Increase		*$ 52*	*$ 50*	*$ 35*	*$ 37*	*$ 39*	*$ 48*	*$ 52*	*$ 55*	*$ 68*	*$ 64*	*$ 59*

For Alternatives B and C the estimated increase in real estate tax is included. The calculation for Alternative C, the 50% General Fund contribution, is shown below.

	FY20	FY21	FY22	FY23	FY24	FY25
Total Levy	$ 15,501,517	$ 16,079,323	$ 16,678,687	$ 17,300,350	$ 17,945,208	$ 18,614,099
General Fund Contribution(GFC)	$ 250,000	$ 250,000	$ 250,000	$ 250,000	$ 250,000	$ 250,000
GFC contribution as % of levy	1.61%	1.55%	1.50%	1.45%	1.39%	1.34%
Mill Rate ($/1000$)	$20.83	$21.40	$22.20	$23.02	$23.88	$24.77
Increase to Mill Rate due to GFC	$0.33	$0.33	$0.33	$0.33	$0.33	$0.33
Mill Rate with GFC	$20.96	$21.73	$22.53	$23.36	$24.22	$25.11
Average single family home valuation	$ 191,233	$ 191,520	$ 191,808	$ 192,097	$ 192,385	$ 192,674
Estimated single family tax bill	$ 3,945	$ 4,098	$ 4,258	$ 4,423	$ 4,595	$ 4,773
Estimated increase in Single Family Tax Bill	$ 63.63	$ 63.72	$ 63.82	$ 63.91	$ 64.01	$ 64.11

1. Total levy includes residential, Commercial and industrial and is escalated by 3.36% annually. (Based upon last ten years of Ware levy totals)
2. 50% of estimated filtration plant debt service = $232,214
3. Funding 50% of filtration plant debt service would result in a $0.33 increase in the mill rate
4. This results in an increase of about $65 per year on the annual property tax for an average single-family home

5.2 Affordability

Affordability is highly subjective; therefore, indicators are used for evaluating cost impacts. An April 2019 report entitled "Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector" commissioned by the American Water Works Association, the National Association of Clean Water Agencies and the Water Environment Federation recommended a new indicator, the Household Burden Indicator (HBI). The degree of financial burden is based upon two elements, the Prevalence of Poverty Indicator (PPI) and the above noted HBI.

The PPI is defined as the percentage of households with incomes at or below 200% of the Federal Poverty Level. For Ware, this value is 35.3% based on 2018 data from the United States Census Bureau.

The HBI is determined by dividing the annual cost of both water and sewer bills by the Lowest Quintile Income (LQI), which was $17,621 according to the 2018 American Community Survey. The HBIs for the analysis period are shown below; note that the income value is

escalated at 1% per year. Sewer costs were calculated using the same usage and assuming a 3% annual increase in rates.

Table 9

General Fund Contribution and Household Burden

Household Burden - LQI Escalated at 1% per year												
Scenario	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
100% Rate Funded	5.9%	6.3%	6.6%	6.8%	7.1%	7.5%	7.9%	8.3%	8.8%	9.8%	10.0%	10.2%
25% GF Contribution	5.9%	6.3%	6.6%	6.8%	7.2%	7.4%	7.7%	8.1%	8.6%	9.2%	9.6%	10.1%
50% GF Contribution	5.9%	6.3%	6.6%	6.8%	7.0%	7.3%	7.6%	7.9%	8.2%	8.6%	8.9%	9.2%

To determine the financial burden the PPI and HBI are entered into the rubric shown below.

Figure 6

PPI and HBI matrix

HBI – Water Costs as a percent of income at LQI	PPI Percent of Households below 200% of FPL		
	>=35%	20% to 35%	< 20%
>= 10%	Very High Burden	High Burden	Moderate - High Burden
7% to 10%	High Burden	Moderate - High Burden	Moderate - Low Burden
< 7%	Moderate - High Burden	Moderate - Low Burden	Low Burden

Ware is at the upper limit of the PPI rubric at 35.3%, under the 100% rate funded scenario the financial burden starts at a moderate to high burden and shifts to high in FY23 and very high in FY30. For the 50% cost share alternative the burden also starts at moderate to high, becoming high in FY23 where it remains throughout the study period.

6 Conclusions and Recommendations

The consideration for a debt service share is based upon the argument that the water system serves most if not all of the non-residential properties in the Town which help lower the residential tax rate. Under the cost share scenarios, the cost to a typical residential household not connected to the water system would consist only of the additional real estate tax of $32 or $65 annually. The Town must decide which scenario best suits its needs.

The water rates from FY21 to FY30 increase by a factor of 2.1x under Alternative A, 2.0x under Alternative B and 1.8x under Alternative C because the debt service for the new filtration plant represents 63% of the total increase in expenses for FY23 but less than 30% in FY30 as the debt from the remaining CIP projects comes on line.

Ware should continue to update the model and revisit rates annually.

Attachments:

A – Water Rate Evaluation Presentation Slides

B – Water Rate Model Hard Copy

J:\W\W2133 Ware NPDES Permit\013 Ware - Water Treatment OPM\Water Rate Study\Design\Ware Rate Evaluation.docx

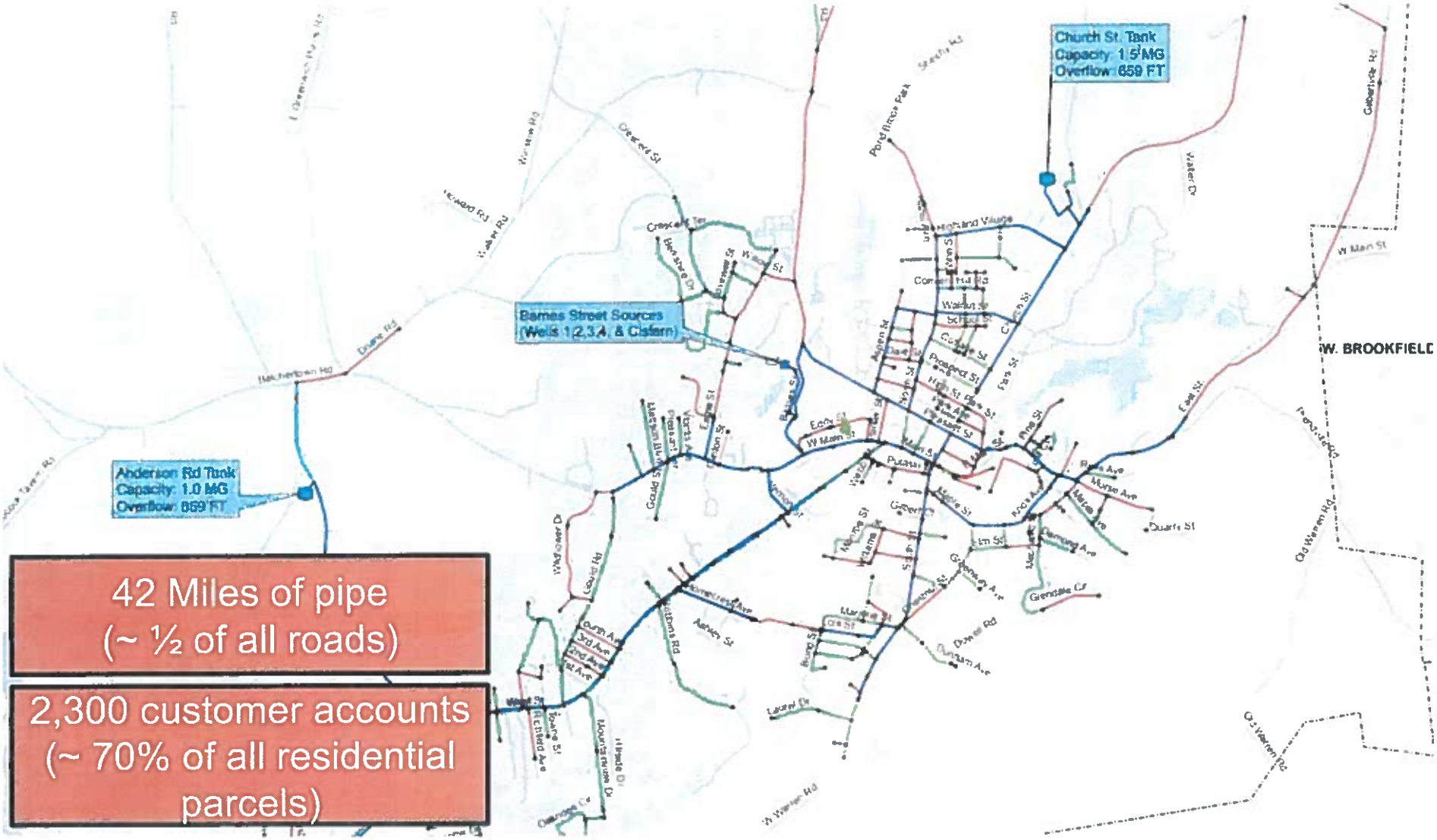
RECOMMENDATIONS

Water and Sewer Rate Evaluations
Ware, MA

Board of Selectmen Meeting
November 16, 2021

Tighe&Bond

VATER SYSTEM



42 Miles of pipe
(~ ½ of all roads)

2,300 customer accounts
(~ 70% of all residential parcels)

Wright Pierce - 2016 Master Plan

Tighe&Bond

CAPITAL NEEDS - WATER

Capital Improvement Planner

ID	System	Scope	Description	Funding source	Interest Rate	Estimated Cost	Start Year	Term
2	Source	Other	Dismal Swamp Well Generator + Well #4	Rate	--	$500 000	2023	1
3	Distribution	Other	Hydrant Replacement (5 per year)	Rate	--	$175 000	2023	1
4	Storage	Eng +Const	Anderson Road Water Tank Rehabilitation	Debt	4 5%	$1 400 000	2024	20
6	Distribution	Eng +Const	Water Main Replacement #1-12" DI (~3 800LF)	Debt	4 5%	$1 520 000	2024	20
5	Storage	Eng +Const	Church St WST Water Tank Rehabilitation	Debt	4 5%	$1 400 000	2025	20
1	Treatment	Eng +Const	Water Filtration Plant	USDA	1 750%	$13 276 000	2026	40
7	Distribution	Eng +Const	Water Main Replacement #2-8" DI (~5 860LF)	Debt	4 5%	$2 000 000	2026	20
8	Distribution	Eng +Const	Water Main Replacement #3-8" DI (~5 860LF)	Debt	4 5%	$2 100 000	2028	20
				Total		$22,371,000		

Pushed back assuming it will be needed in the future

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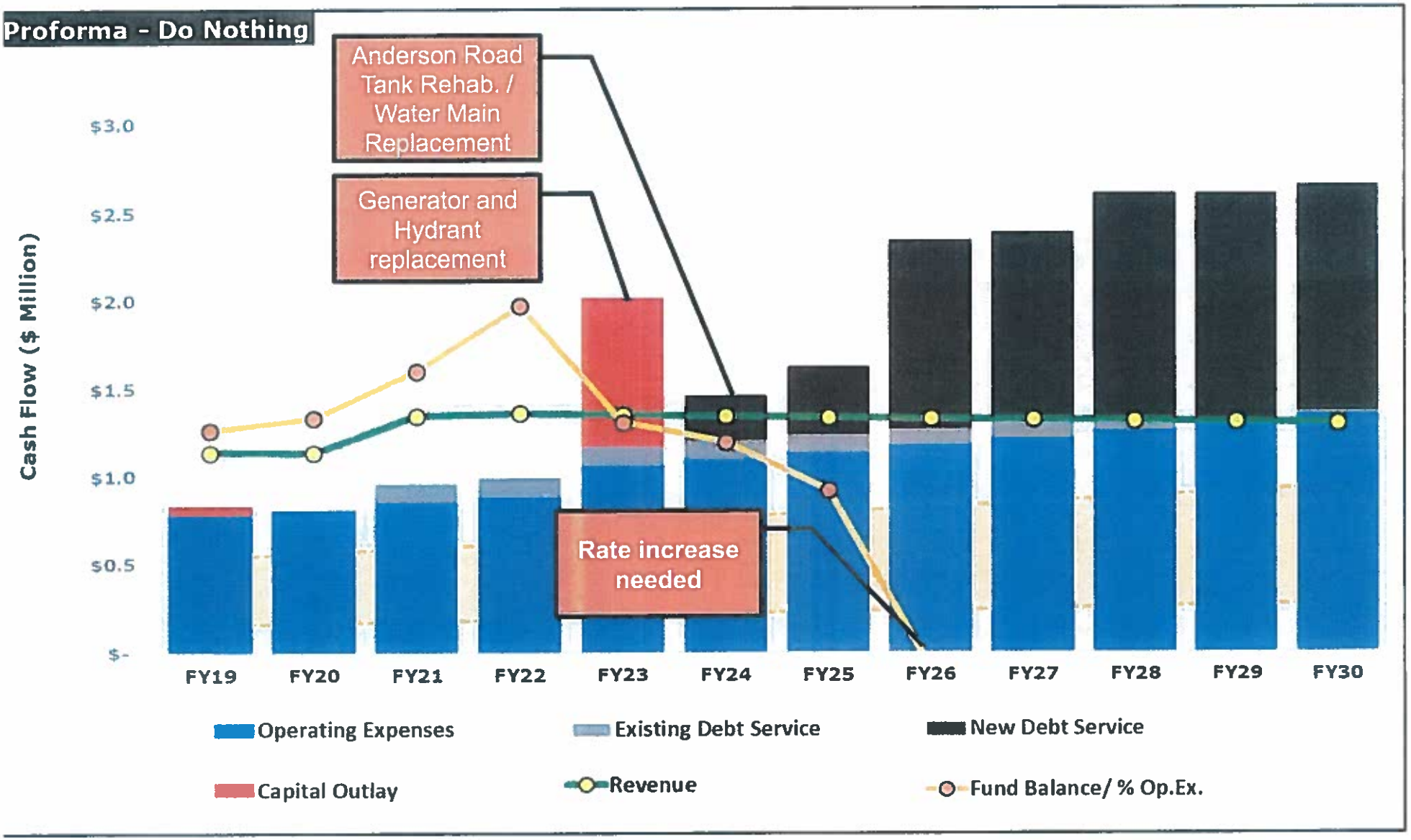
PROFORMA - WATER



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WATER RATES AND CUSTOMER COST

Rates	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Base	$36.00	$36.72	$38.19	$41.24	$45.37	$49.91	$57.39	$66.00	$69.30	$70.69
Usage	$5.25	$5.87	$6.40	$6.59	$7.25	$7.97	$9.17	$10.54	$11.07	$11.29
	Increase (%)	2.0%	8.8%	7.4%	9.1%	9.1%	13.0%	13.0%	4.8%	2.0%
Annual Cost	$373.80	$388.46	$396.74	$428.48	$471.33	$518.46	$596.23	$685.66	$719.94	$734.34
	Increase ($)	$7.46	$15.26	$31.74	$42.85	$47.13	$77.77	$89.43	$34.28	$14.40

Costs based upon 125 gallons per day

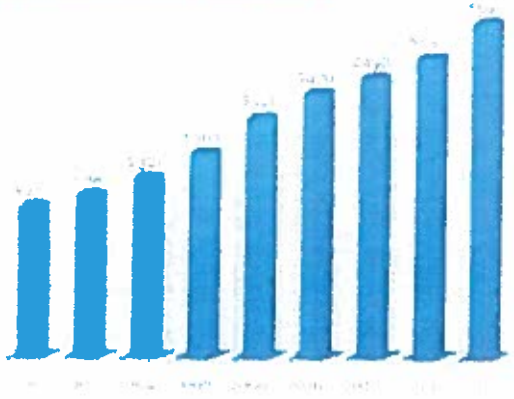
- which equals -

2.5 people using 50 gallons per person per day

- or -

2 people using 65 gallons per person per day

The cost of water is rising, yet often too slowly to cover aging infrastructure.



Annual Average Cost of Water

In 2017 the average cost of water was $595, based upon 250 gallons per day. Converting to 125 gallons per day, the 2017 average cost was $300.

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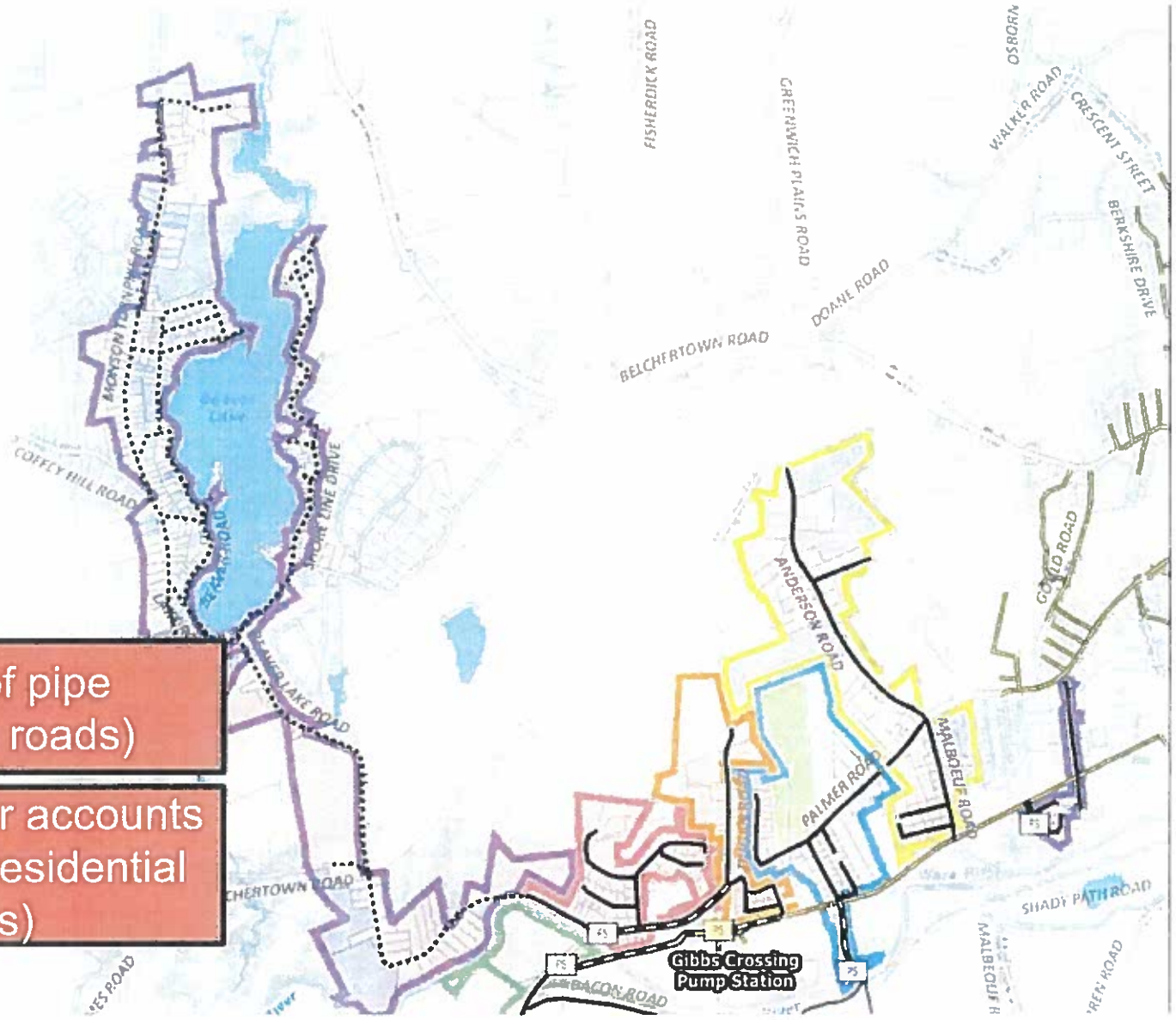
SEWER SYSTEM



23 Miles of pipe
(~ 1/3 of all roads)

1,550 customer accounts
(~ 50% of all residential parcels)

Wright Pierce - 2016 Master Plan

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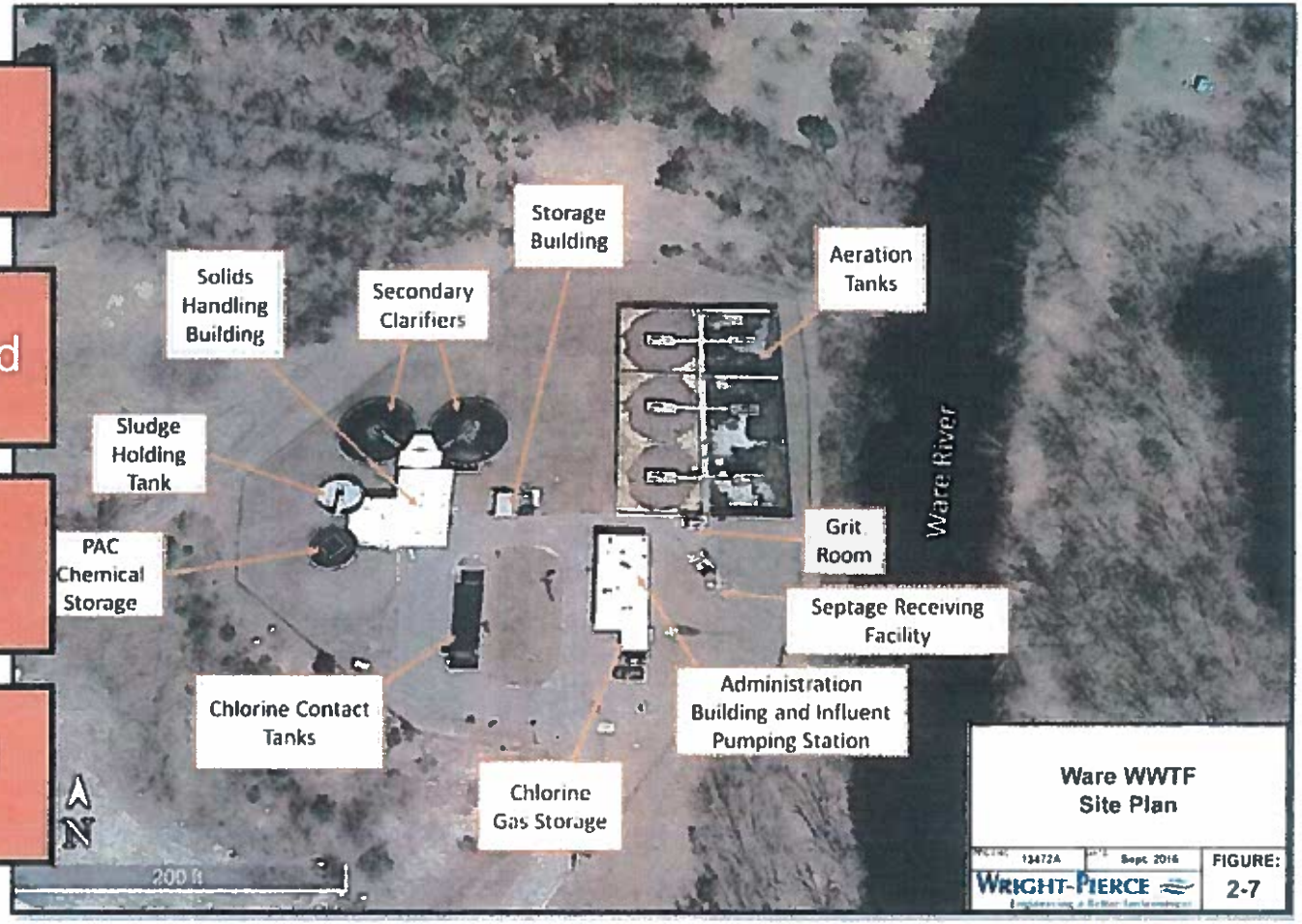
SEWER SYSTEM - WWTP

- Built in 1960's last upgraded in 1980's
- All Mechanical Equipment likely in need of replacement
- New Permit pending
- Currently experiencing significant ragging



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SEWER SYSTEM - WWTP

- Excessive ragging due to flushable wipes is impacting all aspects of operations
- One of 3 influent pumps sent out to repair – leaving no spare
- Threat of sewer overflows into homes / rivers is significantly increased
- New discharge permit likely to include new nutrient removal limits, requiring upgrade

SEWER SYSTEM - WWTP

Proposed screen is designed to remove rags and debris allowing operators to focus on operations

Proposed plant assessment will help define scope of upgrades/ condition

PROJECTING EXPENSES

Capital Improvement Planner

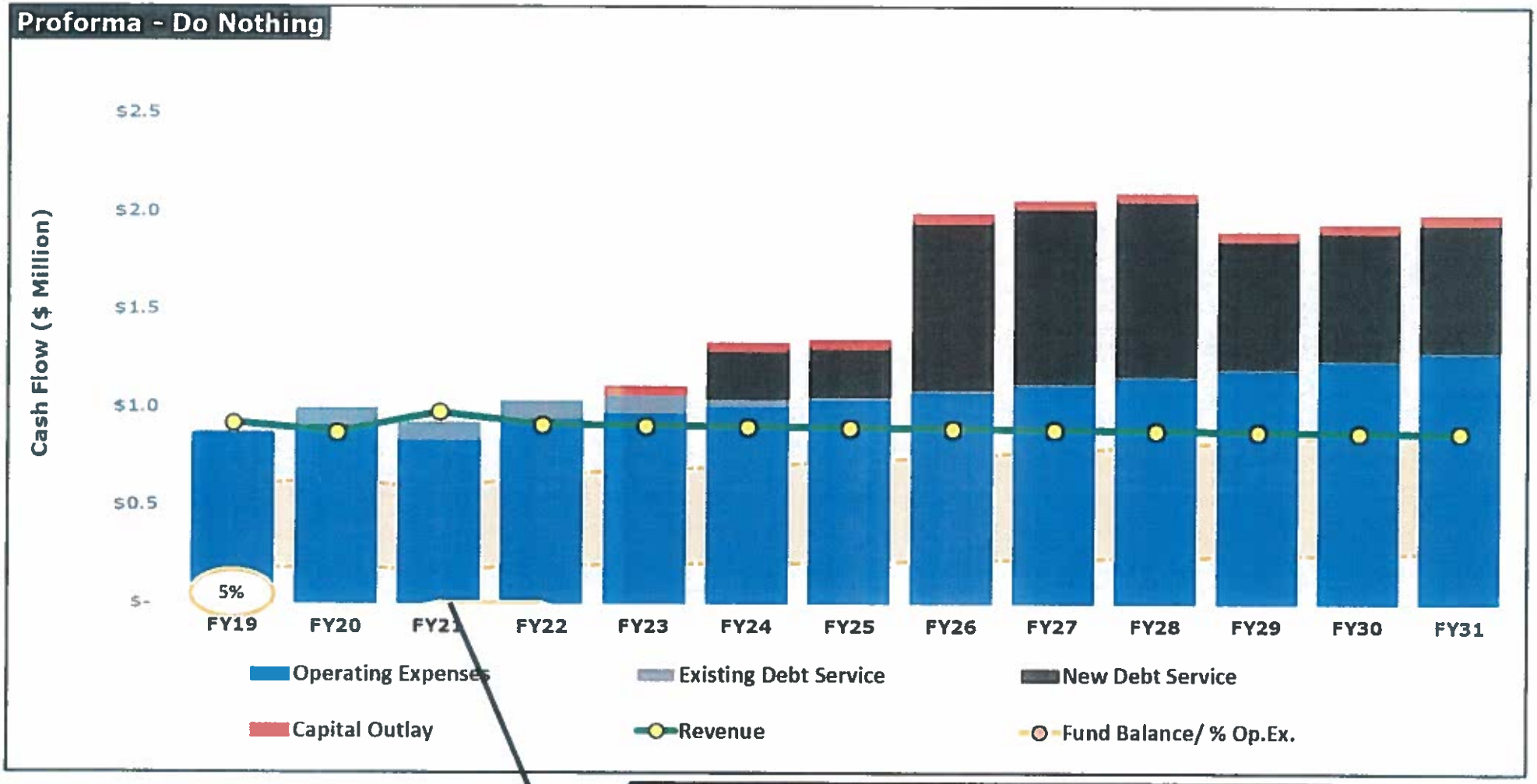
ID	System	Scope	Description	Funding source	Interest Rate	Estimated Cost	Cost Year	Escalated Cost	Start Year	Term
1	Collection	Eng +Const	Influent Screen Upgrade (1)	ARPA		$ 1,400,000	2023	$ 1,400,000	2023	1
2	Collection	Engineering	WWTF Assessment (4)	Rate	--	$ 50,000	2023	$ 50,000	2023	1
2	Treatment	Engineering	WWTF Improvements (3)	Debt	3.0%	$ 1,000,000	2022	$ 1,070,000	2024	5
3	Treatment	Construction	WWTF Improvements (2)	SRF	2.4%	$ 10,000,000	2021	$ 11,600,000	2026	30
4	Collection	Eng +Const	Sewer Rehabilitation	Debt	3.0%	$ 1,000,000	2021	$ 1,200,000	2027	20
5	Collection	Eng +Const	Ongoing SSES and Rehabilitaiton	Rate	--	$ 50,000	2021	$ 50,000	2024	10
6	Collection	Eng +Const	~~Project No. 1 - Longview Street~~	Debt	3.0%	$ -	2021	$ -	2026	20
7	Collection	Eng +Const	~~Project No. 2 - Meadow Ha~~ (6)	Debt	3.0%	$ -	2021	$ -	2027	20
8	Collection	Eng +Const	~~Project No. 3 - Malboeuf Road~~	Debt	3.0%	$ -	2021	$ -	2028	20
9	Collection	Eng +Const	~~Project No. 4 - Mountain View~~	Debt	3.0%	$ -	2021	$ -	2029	20
10	Collection	Eng +Const	~~Project No. 5 - Palmer Road~~	Debt	3.0%	$ -	2021	$ -	2030	20
11	Collection	Eng +Const	~~Project No. 6 - Old Belchertown~~	Debt	3.0%	$ -	2021	$ -	2032	20
12	Collection	Eng +Const	~~Project No. 7 - Beaver Lake~~	Debt	3.0%	$ -	2021	$ -	2033	20
				Total		$13,500,000		$ 15,370,000		

(5)

Notes & Key Points

1. Critical need project, funding with ARPA money was proposed by DPW
2. WWTF Upgrade project: $10M used for planning purposes
3. Design cost assumed to be funded through BAN or other short-term financing
4. Assessment project is to review and update previous (2016) scope and cost
5. ***Timing (start year) based upon distribution of costs NOT upon engineering review of criticality or condition and should be considered as placeholders pending further evaluation. All subsequent rate adjustments and cost impacts are subject to change based upon changes to the CIP.***
6. Need for sewer extensions should be revisited

SEWER PROFORMA



Sewer has been running at a revenue deficit and experienced negative fund balance in FY21, for FY22, $124,500 was transferred from the General Fund to offset the deficit. Rates are not sufficient to fund existing expense.

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SEWER RATES AND CUSTOMER COSTS

Rates	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Base	$44.00	$50.60	$58.19	$66.92	$76.96	$92.35	$106.20	$106.20	$106.20	$106.20
Usage	$5.25	$6.04	$6.94	$7.98	$9.18	$11.02	$12.67	$12.67	$12.67	$12.67
Increase (%)		13.0%	13.0%	13.3%	13.0%	16.7%	13.0%	0.0%	0.0%	0.0%
Annual Cost	$385.00	$442.90	$509.48	$585.96	$673.92	$809.04	$931.56	$931.56	$931.56	$931.56
Increase ($)		$57.90	$66.58	$76.57	$88.06	$135.02	$121.52	$0.00	$0.00	$0.00

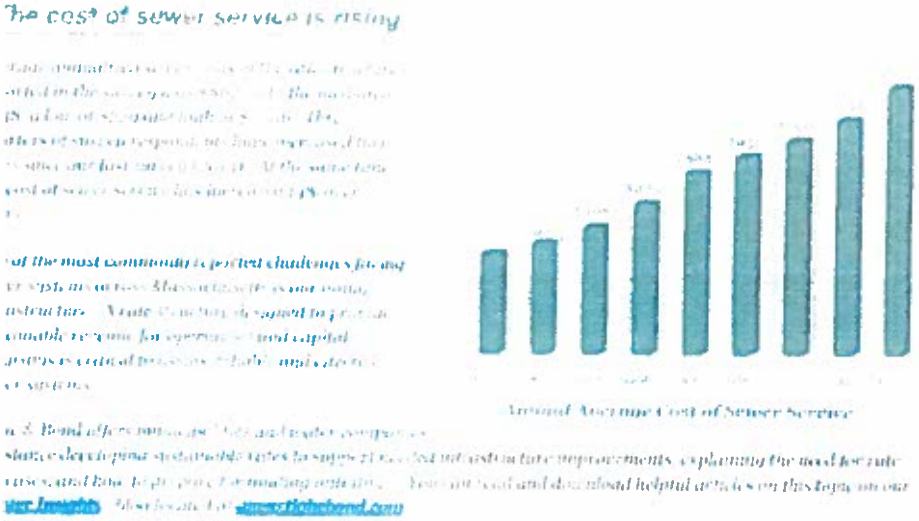
Costs based upon 125 gallons per day

- which equals -

2.5 people using 50 gallons per person per day

- or -

2 people using 65 gallons per person per day



In 2017 the average cost of water was $595, based upon 250 gallons per day. Converting to 125 gallons per day, the 2017 average cost was $431.

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RESIDENTIAL CUSTOMER IMPACTS & AFFORDABILITY -

Measuring Affordability. Affordability, like temperature, is highly subjective. To determine whether or not water and sewer costs represents a financial burden we use the two most common and appropriate indicators.

The Residential Indicator. Adopted from EPA guidance developed in the late 90's to determine the cost impacts of federal regulatory programs, this indicator divides the total annual cost of water and sewer and divides it by the median household income. A score of 4% or more is considered to be a financial burden.

Residential Indicator Annual Cost as % MHI - MHI Escalated at 1% per year

Scenario	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
100% Rate Funded	1.9%	2.1%	2.4%	2.7%	3.1%	3.6%	3.8%	3.9%	3.9%	3.9%

The Household Burden Indicator. *Introduced in 2019, this indicator is based the lowest quintile income (the lowest 20%), which is more representative of household financial status. The second component, the Poverty Prevalence Indicator is the percentage of the community below 200% of the Federal Poverty Level. The burden is determined by using the chart below.*

Household Burden - LQI Escalated at 1% per year

Scenario	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
100% Rate Funded	4.5%	4.9%	5.4%	6.1%	7.0%	7.9%	8.3%	8.4%	8.4%	8.3%

Ware Income Data (US Census)

Median Household Income:	$42,769
Lowest Quintile Income:	$17,621
Poverty Prevalence Indicator:	35%

Household Burden Indicator	Poverty Prevalence Indicator		
	>= 35%	20% to 35%	<20%
> = 10%	Very High Burden	High Burden	Moderate – High Burden
7% to 10%	High Burden	Moderate – High Burden	Moderate - Low Burden
<7%	Moderate - High Burden	Moderate - Low Burden	Low Burden

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