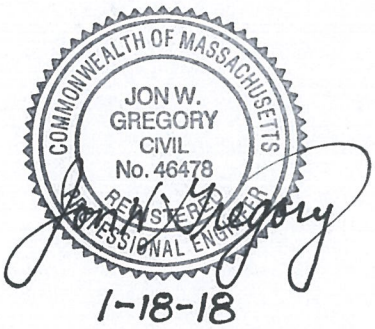
BRP WS 22D
PILOT TEST REPORT
JANUARY 2018

Maher Filtration Plant
Barnstable, Massachusetts

TATA & HOWARD

Pilot Test Report
Maher Filtration Plant
Barnstable, Massachusetts



January 2018

Prepared by

TATA & HOWARD

TATA & HOWARD

January 18, 2018

Mr. Richard Rondeau
Drinking Water Program
Massachusetts Department of Environmental Protection
Southeast Regional Office
20 Riverside Drive
Lakeville, MA 02347

Subject: Request for Approval of a Pilot Study Report
BRP WS 22D – Pilot Study Report = or > 1 mgd
MassDEP Transmittal No. X277113
Barnstable, Massachusetts
T&H No. 5128

Dear Mr. Rondeau:

On behalf of the Town of Barnstable DPW - Water Supply Division, Tata & Howard, Inc. is pleased to submit the enclosed Pilot Test Report for the Maher Water Filtration Plant to the Massachusetts Department of Environmental Protection (MassDEP) for review and approval. Included with the report is a MassDEP BRP WS 22D – Pilot Study Report = or > 1 mgd permit application along with Transmittal Form No. X277113.

The Maher Water Filtration Plant pilot test evaluated the use of pressure filtration using catalytic media for iron and manganese removal, advanced oxidation using ultraviolet light and hydrogen peroxide for 1,4 dioxane removal, and carbon filtration media for removal of Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA) from the existing Maher ground water supply sources. The pilot study was completed using the following technologies:

- GreensandPlus Catalytic Media Pressure Filtration
- LayneOx™ Catalytic Media Pressure Filtration
- Trojan UV - TrojanUVPhox™ 12AL30 UV-Oxidation System
- Calgon FILTRASORB 400 carbon media (bituminous coal-based)

The enclosed pilot test report has been prepared in accordance with MassDEP Policy #90-04 "Pilot Study Requirements for Proposed Treatment". Piloting has been completed in accordance with the Pilot Test Proposal submitted and approved by the MassDEP under Transmittal No. X275188 dated July 7, 2017.

Tata & Howard
67 Forest Street | Marlborough, MA 01752
T: 508-303-9400 | F: 508-449-9400
www.tataandhoward.com

Other Offices
MA | NH | CT | ME | VT | AZ | TX

A copy of this report is also being submitted to the MassDEP Boston Office Drinking Water Program with a request for BRP WS 12 – Major New Technology Approval where Field Testing is Required (Transmittal No. X277368), for removal of 1,4 dioxane using advanced oxidation.

We are available to discuss any questions you may have regarding this report at your convenience. Please call should you have any questions or require additional information in this regard.

Sincerely,

TATA & HOWARD, INC.

Jon W. Gregory, P.E.
Associate

Enclosures

cc: Mr. Hans Keijser, Supervisor
Barnstable DPW - Water Supply Division

Mr. Michael Gorenstein, P.E., Project Manager
Barnstable DPW - Water Supply Division

Enter your transmittal number → X277113 (Transmittal Number)

Your unique Transmittal Number can be accessed online: http://mass.gov/dep/service/online/trasmfrm.shtml

Massachusetts Department of Environmental Protection

Transmittal Form for Permit Application and Payment

1. Please type or print. A separate Transmittal Form must be completed for each permit application.

2. Make your check payable to the Commonwealth of Massachusetts and mail it with a copy of this form to: DEP, P.O. Box 4062, Boston, MA 02211.

3. Three copies of this form will be needed.

Copy 1 - the original must accompany your permit application. **Copy 2** must accompany your fee payment. **Copy 3** should be retained for your records

4. Both fee-paying and exempt applicants must mail a copy of this transmittal form to:

MassDEP
P.O. Box 4062
Boston, MA
02211

*** Note:**
For BWSC Permits, enter the LSP.

A. Permit Information

1. Permit Code: 4 to 7 character code from permit instructions	2. Name of Permit Category
BRP WS 22D	Pilot Study Report = or > 1 mgd

3. Type of Project or Activity: Pilot Test for Existing Groundwater Supply

B. Applicant Information – Firm or Individual

1. Name of Firm - Or, if party needing this approval is an individual enter name below: Town of Barnstable Department of Public Works - Water Supply Division

2. **Last Name** of Individual	3. **First Name** of Individual	4. MI

5. Street Address: 47 Old Yarmouth Road

6. City/Town	7. State	8. Zip Code	9. Telephone #	10. Ext. #
Hyannis	MA	02601	508-775-0063	

11. Contact Person	12. e-mail address
Hans Keijser	Hans.Keijser@town.barnstable.ma.us

C. Facility, Site or Individual Requiring Approval

1. Name of Facility, Site Or Individual: Maher Water Treatment Plant

2. Street Address: 47 Old Yarmouth Road

3. City/Town	4. State	5. Zip Code	6. Telephone #	7. Ext. #
Hyannis	MA	02601	508-775-0063	

8. DEP Facility Number (if Known)	9. Federal I.D. Number (if Known)	10. BWSC Tracking # (if Known)

D. Application Prepared by (if different from Section B)*

1. Name of Firm Or Individual: Tata & Howard, Inc.

2. Address: 10 Riverside Drive, Suite 204

3. City/Town	4. State	5. Zip Code	6. Telephone #	7. Ext. #
Lakeville	MA	02347	508-386-9339	

8. Contact Person	9. LSP Number (BWSC Permits only)
Jon W. Gregory, P.E.	

E. Permit - Project Coordination

1. Is this project subject to MEPA review? ☐ yes ☒ no
   If yes, enter the project's EOEA file number - assigned when an Environmental Notification Form is submitted to the MEPA unit:

EOEA File Number

F. Amount Due

DEP Use Only

Permit No:

Rec'd Date:

Reviewer:

Special Provisions:

1. ☒ **Fee** Exempt (city, town or municipal housing authority)(state agency if fee is $100 or less).
   There are no fee exemptions for BWSC permits, regardless of applicant status.
2. ☐ Hardship Request - payment extensions according to 310 CMR 4.04(3)(c).
3. ☐ Alternative Schedule Project (according to 310 CMR 4.05 and 4.10).
4. ☐ Homeowner (according to 310 CMR 4.02).

Check Number	Dollar Amount	Date

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Drinking Water Program

X277113
Transmittal Number

BRP WS Application

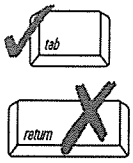
For Drinking Water Program (Water Supply) Permits or Approvals

Facility ID# (if known)

A. Application

1. Is this application for ☒ an Original or ☐ a Resubmittal?

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



2. Applicant:

Name			Address	
Town of Barnstable			47 Old Yarmouth Road	
City	**State**	**Zip**	**Contact**	**Telephone**
Hyannis	MA	02601	Hans Keijser	508-775-0063

3. Consultant:

Name			Address	
Tata & Howard, Inc.			10 Riverside Drive, Suite 204	
City	**State**	**Zip**	**Contact**	**Telephone**
Lakeville	MA	02347	Jon W. Gregory, P.E.	508-386-9339

B. Permit

Please check the permit or approval for which you are applying:

Zone II Determination for Existing Sources
- ☐ BRP WS 07 Approval to Conduct Pump Test for Zone II Delineation
- ☐ BRP WS 08 Approval of Zone II Delineation

New Technology
- ☐ BRP WS 11 Minor New Technology Approval; where no field test required
  - ☐ Drinking Water Additive
  - ☐ Cross Connection Device
  - ☐ Water Vending Machine
  - ☐ Other (specify):
- ☐ BRP WS 12 Major New Technology Approval: where field testing is required
- ☐ BRP WS 27 New Technology with Third-party Approval
- ☐ BRP WS 28 Vending Site/Source Prototype
- ☐ BRP WS 31 Vending and POU/POE Devices with Third-party Approval

New Source Approvals <70 gpm
- ☐ BRP WS 13 Exploratory Phase, Site Examination, Land Use Survey and Approval to Conduct Pumping Test
- ☐ BRP WS 15 Pumping Test Report Approval and Approval to Construct Source
- ☐ BRP WS 37 Approval of Transient Non-Community Source Less than 7 Gallons per Minute (combines BRP WS 13 and BRP WS 15 submittals)

New Source Approvals = or > 70 gpm
- ☐ BRP WS 17 Exploratory Phase, Site Examination, Land Use Survey, and Conduct Pumping Test
- ☐ BRP WS 19 Pumping Test Report Approval
- ☐ BRP WS 20 To Construct Source

Water Treatment Approvals
- ☐ BRP WS 21A To Conduct Pilot Study < 40,000 gpd
- ☐ BRP WS 21B To Conduct Pilot Study = or > 40,000 gpd and < 200,000 gpd
- ☐ BRP WS 21C To Conduct Pilot Study = or > 200,000 gpd and < 1 mgd
- ☐ BRP WS 21D To Conduct Pilot Study = or > 1 mgd
- ☐ BRP WS 22A Pilot Study Report < 40,000 gpd
- ☐ BRP WS 22B Pilot Study Report = or > 40,000 gpd and < 200,000 gpd
- ☐ BRP WS 22C Pilot Study Report = or > 200,000 gpd and < 1 mgd
- ☒ BRP WS 22D Pilot Study Report = or > 1 mgd
- ☐ BRP WS 23A To Construct Facility <40,000 gpd
- ☐ BRP WS 23B To Construct Facility = or > 40,000 gpd and < 200,000 gpd
- ☐ BRP WS 23C To Construct Facility = or > 200,000 gpd and < 1 mgd
- ☐ BRP WS 24 To Construct Facility = or > 1 mgd
- ☐ BRP WS 25 Treatment Facility Modification
- ☐ BRP WS 29 Water Treatment: Chemical Addition Retrofits of Water Systems > 3,300 people
- ☐ BRP WS 30A Vending Installation Approval
- ☐ BRP WS 30B POU/POE Installation Approval
- ☐ BRP WS 34 Water Treatment: Chemical Addition Retrofits of Water Systems = or < 3,300 people
- ☐ BRP WS 35A Multiple Vending Installation Approval
- ☐ BRP WS 35B Multiple POU/POE Installation Approval

Water Quality Assurance
- ☐ BRP WS 26 Sale or Acquisition of Land for Water Source
- ☐ BRP WS 36 Abandonment of Water Source

Distribution System Modifications
- ☐ BRP WS 32 Systems > 3,300 people
- ☐ BRP WS 33 Systems = or < 3,300 people

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Drinking Water Program

BRP WS Application

For Drinking Water Program (Water Supply) Permits or Approvals

X277113
Transmittal Number

Facility ID# (if known)

C. Certification

"I certify, under penalty of law, that this application and all attachments were prepared under my supervision, in accordance with a system designed to ensure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information submitted in this application, the information submitted is, to the best of my knowledge and belief, true, accurate and complete."

Jon W. Gregory
Authorized Signature

1-18-18
Date

Jon W. Gregory, P.E.
Print Name

Associate
Position/Title

EXECUTIVE SUMMARY

Four treatment processes were piloted in this pilot test for the new Maher Filtration Plant. Pressure Filtration with Adsorptive Media, Advanced Oxidation, and Granular Activated Carbon (GAC) were selected as the pilot treatment technologies. Pressure Filtration with Adsorptive Media included GreensandPlus and LayneOx™ filtration for iron and manganese removal. Advanced Oxidation utilizes ultraviolet (UV) light treatment and hydrogen peroxide for 1,4-dioxane reduction. GAC filters provide treatment and contaminant removal, including PFOS/PFOA, and also act as a polishing filter process to maintain a stable, consistent finished water quality. The treatment technologies were tested in series followed by an extended pilot run utilizing only advanced oxidation and GAC filtration. Chemical pretreatment was required for iron and manganese removal (sodium hypochlorite for oxidation of iron and manganese and potassium hydroxide for pH adjustment) and 1,4-dioxane removal (hydrogen peroxide), but was not required for PFOS/PFOA removal. Sodium hypochlorite and potassium hydroxide were injected into the raw water for oxidation/disinfection and pH adjustment under the pressure filtration process, and hydrogen peroxide and Carus 1205 were injected prior to the UV system for 1,4 dioxane removal and sequestering of iron and manganese, respectively, under the advanced oxidation process.

The pilot test also determined how the sequestering chemical and the presence of iron and manganese affected the efficiency of the advanced oxidation process for 1,4-dioxane removal, should iron and manganese removal processes not be utilized.

Pilot test results indicate that both GreensandPlus and LayneOx™ were capable of removing iron and manganese to concentrations below the Secondary Maximum Contaminant Levels (SMCLs) of 0.3 mg/L and 0.05 mg/L, respectively.

Initial advanced oxidation pilot testing utilizing a small generic UV system produced 1,4-dioxane concentrations of 0.691 and 0.663 µg/L, which are well above the regulatory limit of 0.3 µg/L. Based on these concentrations, the small generic UV system was not successful in removing 1,4-dioxane likely due to insufficient lamp power necessary for the oxidation process. Subsequent testing utilizing a larger Trojan UV system was effective in the destruction of 1,4-dioxane to below the regulatory limit of 0.3 µg/L. All laboratory results from the advanced oxidation pilot test with the large Trojan UV system were below the laboratory detection limit of 0.144 µg/L. Weekly visual inspection of one of the UV lamp sleeves showed no visual indication of fouling throughout the study. Results of the GAC pilot test runs show that the contactors were capable of removing PFOS/PFOA to below detection limits in all laboratory analyzed samples.

The results from pilot testing led to the development of two treatment options, which were evaluated as part of this report. One option includes iron and manganese removal and one does not.

Treatment Option No. 1 includes a 66’ x 95’ metal building, advanced oxidation and GAC filtration equipment and all appurtenances, chemical feed equipment, backwash

holding tank for residuals management, site work, concrete work, electrical, instrumentation, mechanical, plumbing, and fire protection. The total estimated capital cost of Option No. 1 is $7,615,000. The estimated first year operation and maintenance cost associated with Option No. 1 is $320,000. Option No. 1 limits new treatment at the facility to 1,4 dioxane removal and PFOS/PFOA removal. Removal of iron and manganese is not included in this option.

Treatment Option No. 2 includes all items in Option No. 1 for PFOS/PFOA removal and 1,4-Dioxane removal and also includes the installation of greensand filtration for iron and manganese removal, which will help optimize the treatment processes under Option No. 1. The total estimated capital cost of Option No. 2 is $9,970,000. The estimated first year operation and maintenance cost associated with Option No. 2 is $373,000.

If the Town chooses to proceed with Option No. 1, capital costs to implement greensand filtration at the new facility at a future date (assumed Year 2024) will increase by approximately $850,000 when compared to the cost to implement greensand filtration under Option No. 2 at present. This includes construction, additional design, permitting, MassDEP approval, and bidding requirements.

The results of pilot testing suggest that implementation of iron and manganese removal treatment processes may not be required at this time. Average raw water total iron concentrations were below the SMCL and average raw water concentrations of manganese exceeded the SMCL but were below the Massachusetts Office of Research and Standards Guideline (MA ORSGL) of 0.3 mg/L and MassDEP's current enforcing limit of 0.21 mg/L (70% of the MA ORSGL). The ORSGL was developed to address potential health concerns of manganese in drinking water. During the extended advanced oxidation pilot testing, there was no visual evidence of UV lamp sleeve fouling based on weekly inspections. Testing completed by Trojan UV on a sample UV lamp sleeve from the pilot test UV reactor determined that the fouling factor of the pilot sleeve was 0.94, which is within the limits of Trojan UV's classification of satisfactory. The UV reactor wiping mechanism (operated every two hours) used to clean residue on the lamp sleeves likely helped reduce fouling. Although there was evidence of iron removal in the GAC media based on water quality data and some visual accumulation at the surface of the media, the differential pressure never approached 10 psi, which is when a backwash would normally be initiated. The GAC contactors did not require backwashing during the pilot test.

Although pilot testing results suggest that the need for iron and manganese removal may not be immediate, implementation of Option No. 2, which includes greensand filtration, advanced oxidation, and GAC filtration, is recommended. The following summarizes reasons for this recommendation:

- The removal of iron and manganese would improve water quality within the water distribution system and, subsequently, reduce the amount of dirty water calls from water customers and reduce the amount of system flushing.

- Removal of iron and manganese ahead of advanced oxidation and GAC filtration would benefit the functionality, efficiency, and life span of the equipment and media.
- There is the potential for the ORSGL for manganese to be reduced in the future pending further research by State and Federal agencies.
- Intervals between backwashing of the GAC contactors would increase resulting in an increase in the life span of the carbon media.
- Although backwashing of the GAC contactors was not required during pilot testing, it is anticipated that the introduction of iron to the carbon media for an extended period of time at the full-scale facility would require periodic backwashing of the carbon media, which would not normally be needed if iron were not present in the water.
- It is anticipated that the filtration plant will operate with minimal interruptions during the summer months. This may minimize the ability of the carbon filter bed to expand during shutdowns to compensate for the added iron removal and lead to an increase in differential pressure requiring more frequent backwashing of the carbon media if greensand filtration is not implemented.
- Fouling of the UV lamp sleeves associated with advanced oxidation would be reduced, thereby improving the efficiency of the equipment and lengthening the lamp replacement interval.
- Sequestering of iron and manganese would no longer be required resulting in reduced chemical costs.
- Construction of all proposed treatment processes under one construction contract (Option No. 2) in lieu of Option No. 1 and implementing greensand in the future would simplify design and optimize construction of the filtration plant and result in a substantially lower total project cost.

Implementation of either Option No. 1 or Option No. 2 would result in a current schedule for completion and full operation of the plant in July 2020.

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Section 1

TATA & HOWARD

SECTION 1 - INTRODUCTION

1.1 General

The purpose of this report is to present the results of the pilot testing program conducted at the Maher Water Treatment Plant in Barnstable, Massachusetts for the Town of Barnstable Department of Public Works (DPW) – Water Supply Division, also known as the Hyannis Water System, and provide recommendations for treatment systems necessary to remove iron and manganese, 1,4-dioxane, Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA) from the Maher Well Nos. 1, 2, and 3. The pilot testing was completed in accordance with the Pilot Test Proposal, dated June 2, 2017, approved by the Massachusetts Department of Environmental Protection (MassDEP), included in Appendix A.

Pilot testing was performed from July 17, 2017 through September 28, 2017. Additional pilot testing using raw water and a single carbon filter was also completed from October 6, 2017 through November 8, 2017.

It should be noted that at the start of pilot testing, all three Maher Wells were used. Initial raw water field data indicated that in most cases, Well No. 3 had contaminant concentrations that were lower than the average concentrations of the contaminants from Well Nos. 1 and 2. Well No. 3 was not used during pilot testing after July 31, 2017.

1.2 Background

The Town of Barnstable, Massachusetts has a current population of approximately 18,000 winter residents and 35,000 summer residents and is bordered by Cape Cod Bay to the north, Nantucket Sound to the south, Mashpee and Sandwich to the east, and Yarmouth to the west. The Maher Water Treatment Plant (WTP) treats three gravel packed water supply wells, Maher Well No. 1, Maher Well No. 2, and Maher Well No. 3. Each well is permitted through the Water Management Act Permit Program to produce an average of 1.008 mgd, which is equivalent to a pumping rate of 700 gallons per minute (gpm) over a 24-hour period. Each well pump can currently produce approximately 500 to 550 gpm. The maximum capacity through the existing WTP is approximately 2.16 mgd (1,500 gpm).

Each well source is treated with a blended phosphate to sequester iron and manganese in solution and then pumped to the Maher WTP. The water from each source is combined and treated through an air stripper to remove volatile organic compounds (VOCs) and discharges into a below grade clearwell. At present, the interconnection with the Town of Yarmouth is temporarily used to blend Yarmouth water with the Maher wells in the clearwell to reduce PFOS/PFOA and 1,4 dioxane concentrations. Once the new filtration plant is in service, the interconnection will be shut down and retained as an emergency interconnection with the Town of Yarmouth water system. Water is pumped from the clearwell and treated with chemical addition for disinfection (sodium hypochlorite), pH adjustment (sodium hydroxide), and corrosion control (zinc orthophosphate). Finished

water is stored in the onsite 800,000-gallon capacity Maher Water Storage Tank. This tank provides contact time for compliance with 4-log disinfection requirements, if needed in the future under the Groundwater Rule. The yard piping configuration at the WTP provides operators with the flexibility to use the finished water pumps to feed the Maher Water Storage Tank or the distribution system directly. A site map is provided in Appendix B.

Currently, raw water from the three Maher wells contain levels of PFOS/PFOA and 1,4-dioxane that require treatment/removal to provide optimum water quality to customers. Since the elevated levels of contaminants were discovered, the Town has made efforts to reduce the levels of PFOS/PFOA and 1,4 dioxane at the Maher WTP. Well No. 1 and Well No. 3, which historically exhibited the highest PFOS/PFOA levels, were taken off-line. The water system interconnection with the Town of Yarmouth was designed and constructed to temporarily blend Yarmouth supplied water with water from the Maher Wells in an effort to reduce the concentrations of PFOS/PFOA and 1,4 dioxane.

1.3 Purpose

MassDEP guidelines require that all water treatment projects complete a pilot test proposal, pilot testing, and a pilot test report. Pilot testing was completed to develop a treatment method to produce water that consistently meets State and Federal drinking water standards; specifically, to reduce the levels of PFOS/PFOA, 1,4-dioxane, and iron and manganese to below set levels established by State and Federal agencies, and to provide flexibility with the new treatment systems for treatment of emerging contaminants in the future. The pilot testing results assisted in determining the specific operational and performance characteristics of a treatment process throughout the anticipated range of raw water quality, hydraulic loading, chemical feed rates, and operational conditions.

This pilot test report contains the duration and timeframe of the pilot testing, the water quality parameters and specific analyses completed, and a discussion of the recommended proposed methods of water treatment based on the results of the pilot testing. Preparation of budget estimates of capital and operational costs for the recommended treatment facility upgrades is also presented in this report.

All references to the Pilot Study Report - Blueleaf, Inc. (Blueleaf Report) refer to the Blueleaf Report located in Appendix C of this report.

Section 2

TATA & HOWARD

SECTION 2 – WATER QUALITY

2.1 General

Primary drinking water regulations are established by the United States Environmental Protection Agency (USEPA) and MassDEP to protect public health and to set enforceable maximum contaminant levels (MCLs). The USEPA has also established secondary maximum contaminant levels (SMCLs) for water quality criteria that generally affect the aesthetic qualities of drinking water, such as taste, color, odor, and appearance. USEPA lifetime Health Advisory (HA) levels establish maximum concentrations of contaminants in drinking water for which cancer and noncancer health effects are not anticipated to occur over exposure duration of one day, ten days, and a lifetime for children and adults. The HAs are not enforceable but serve as guidance for Federal, State, local officials, and water systems. In addition, the Massachusetts Office of Research and Standards have also set Guideline Limits (MA ORSGL) for contaminants.

2.2 Water Quality Data and Drinking Water Standards

Although the raw water from Maher Well Nos. 1, 2, and 3 and finish water quality from the Maher WTP currently meet all applicable primary drinking water standards, raw water quality has shown high concentrations of PFOS, PFOA, and 1,4-dioxane above the USEPA's HA levels and MA ORSGL. In addition, finish water quality from the Maher WTP have shown elevated concentrations of manganese. Table No. 2-1 summarizes the maximum levels of PFOS/PFOA, 1,4-dioxane, iron, and manganese measured at the WTP from recent available sampling results, and the regulatory levels at which the MassDEP requires compliance. PFOS/PFOA levels are combined in Table No. 2-1 to show the total level at each source, since the regulatory HA level is based on the combined PFOS/PFOA level. Iron and manganese levels were measured in raw water samples.

Table No. 2-1
Summary of Most Recent Maher Source Water Quality Results and Regulatory Compliance Levels

Contaminant	Maher No. 1	Maher No. 2	Maher No. 3	Compliance Regulation	Regulation Level
PFOS/PFOA (µg/l)	0.132	0.0373	0.084	USEPA HA	0.07 µg/l
1,4-dioxane (µg/l)	0.44	1.4	ND	MA ORSGL	0.3 µg/l
Iron (mg/l)	0.53	0.366	<0.05	N/A	N/A
				SMCL (non-enforceable)	0.3 mg/l
Manganese (mg/l)	0.084	0.098	0.102	MA ORSGL	0.3 mg/l
				SMCL (non-enforceable)	0.05 mg/l

Combined PFOS/PFOA concentrations exceeded the lifetime HA level at Maher No. 1 and Maher No. 3. It should be noted that the PFOS/PFOA concentration of 0.132 µg/l at Maher Well No. 1 is nearly twice the lifetime HA level of 0.07 µg/l. Water quality results from Maher Well No. 1 and 2 exceeded the ORSGL of 0.3 µg/l for 1,4-dioxane. The high 1,4 dioxane result from Well No. 2 in Table No. 2-1 may not be indicative of the actual concentration in the well. During pilot testing, the average raw water 1,4 dioxane level in eleven samples of combined water from Well No. 1 and Well No. 2 was 0.489 µg/l.

Although manganese sample results were below the MA ORSGL of 0.3 mg/l, manganese concentrations exceeded the SMCL of 0.05 mg/l. Water quality sample results for iron did not exceed the SMCL of 0.3 mg/l. Although iron and manganese levels can increase over time at a well source, historical manganese levels have been relatively consistent at the Maher Wells and remain below the MA ORSGL.

2.3 Water Quality Goals

The historical water quality data compiled prior to pilot testing indicates that the raw water from the Maher Wells requires treatment for the removal of PFOS/PFOA and 1,4-dioxane to meet Federal and State drinking water standards. Pilot test processes were conducted to determine the effectiveness of each process for the WTP. The pilot study determined the specific operation and performance characteristics of the selected treatment processes through the anticipated range of raw water quality, hydraulic loading rates, chemical feed rates, and operational conditions. The goal of the pilot test is to evaluate and determine the most cost effective and straightforward treatment process(es) to operate and maintain, and that will not produce excessive quantities of residuals while meeting State and Federal existing and projected regulations for iron, manganese, 1,4-dioxane, and PFOS/PFOA.

Section 3

TATA & HOWARD

SECTION 3 – TREATMENT ALTERNATIVES

3.1 Process Evaluation

Pressure Filtration with Adsorptive Media, Advanced Oxidation, and Granular Activated Carbon (GAC) were selected as the pilot treatment technologies. Pressure Filtration with Adsorptive Media included GreensandPlus and LayneOx™ filtration for iron and manganese removal. This process would replace the existing iron and manganese sequestering practices utilized at the WTP. Advanced Oxidation utilizes ultraviolet (UV) light treatment and hydrogen peroxide for 1,4-dioxane reduction. GAC filters provide treatment and contaminant removal, including PFOS/PFOA, and also act as a polishing filter process to maintain a stable, consistent finished water quality.

3.2 Pressure Filtration with Adsorptive Media

GreensandPlus and LayneOx™ were selected as the media filtration for iron and manganese removal. Raw water iron and manganese are typically oxidized by chemical pretreatment before filtration. Oxidation can be achieved with chlorination using sodium hypochlorite or alternative oxidants. The adsorptive properties of the filtration media must be maintained by regeneration, which consists of exposing the media to the oxidant. With Continuous Regeneration (CR), the oxidant is fed continuously during filtration at a dose that is sufficient to satisfy the oxidant demand of the raw water and provide an excess for media regeneration.

Iron precipitates are large enough to be removed by mechanical filtration, or entrapment within the interstices of the filtration media. Iron can also be removed by adsorption to the filtration media. Manganese precipitates are typically too small to be effectively removed by mechanical filtration, and therefore, are removed by adsorption.

3.2.1 Greensand Plus

GreensandPlus, the trade name for Inversand's oxide-coated sand product, is a manufactured filter media used for the removal of iron, manganese, hydrogen sulfide, arsenic, and radium from water supplies. The substrate media has a manganese dioxide coated surface that acts as a catalyst in the oxidation-reduction reaction of manganese. The difference between GreensandPlus and conventional manganese greensand is in the substrate that forms the core of the media and the method by which the manganese dioxide coating is attached to that substrate. GreensandPlus has a silica sand core and the coating is fused to it. Manganese Greensand has a glauconite core and the coating is ionically bound to the core. This difference enables GreensandPlus to absorb soluble manganese and use chlorine for regeneration, while Manganese Greensand requires the use of potassium permanganate and has a limited pH range of 6.8 to 7.2. GreensandPlus can also operate at a higher loading rate than conventional greensand, 8 gallons per minute per square foot (gpm/sf) or greater compared to 2 to 5 gpm/sf. GreensandPlus has an operational pH range of 6.2 to 8.5 and is more durable than conventional greensand.

The GreensandPlus process utilizes a layer of anthracite which acts as a physical filter for the iron and manganese precipitated by the addition of the chlorine oxidant. Below the anthracite top layer is an oxide-coated sand media, which acts as a catalyst in the oxidation of the manganese. Manganese that is oxidized in this part of the process is then removed via adsorption or physical filtration. An additional benefit with the use of GreensandPlus media for removal of iron and manganese is that it will also reduce the amount of sedimentation and chlorine demand in the distribution system, and will no longer require sequestering of iron and manganese during the water treatment process.

3.2.2 LayneOx™

LayneOx™ is a proprietary catalytic media marketed by Layne-Christensen Company. It is a naturally occurring mined manganese dioxide pyrolusite media that has been used in treatment plants throughout the United States. The media has a very high manganese dioxide content, averaging 60 percent, which eliminates the need for the addition of potassium permanganate. LayneOx™ is not pH sensitive within recommended pH ranges for drinking water. Its relatively high hardness may provide a longer service life than the softer greensand media, and unlike greensand, air scouring in the initial phases of backwashing is not necessary but often used to enhance the process.

LayneOx™ solely utilizes adsorption for the removal of manganese, which translates to filter loading rates ranging from 4 to 12 gpm/sf depending on the raw water quality and desired backwash frequency (i.e. once per 24 hours of operation).

3.3 Advanced Oxidation

Advanced oxidation uses UV light with hydrogen peroxide to remove 1,4-dioxane. UV oxidation is a photochemical process that breaks down chemical constituents into their physiologically-inert component parts. This process includes the addition of hydrogen peroxide to the influent water followed by a photochemical reaction that occurs almost instantly within the UV reactor. The irradiation of hydrogen peroxide by UV light breaks the hydrogen peroxide into two hydroxyl radicals. These highly reactive radicals oxidize 1,4-dioxane, breaking it down into its non-toxic molecular components.

3.4 Granulated Activated Carbon Filtration

GAC filtration has proven to be effective in removal of PFOS/PFOA from drinking water, and is commonly used for their adsorption in water systems. Adsorption is a physical and chemical process of accumulating a substance at the interface between the liquid and solid media phases. Water will enter the carbon filters following iron and manganese sequestering or pressure filtration, and advanced oxidation treatment. The GAC filters will quench any residual hydrogen peroxide from the advanced oxidation process. The quenched residual hydrogen peroxide will not adsorb to the carbon media. The media will convert the residual hydrogen peroxide to water through the catalytic function then pass through the carbon filter bed and, therefore, it will not add to the

carbon usage rate. The hydrogen peroxide dosage rate can also be optimized to minimize the residual carryover of hydrogen peroxide from the advanced oxidation process.

Section 4

TATA & HOWARD

SECTION 4 – REMOVAL OF MANGANESE OPTIONS

4.1 General

Blueleaf, Inc. (Blueleaf) was retained by Tata & Howard and the Town to conduct pilot testing of GreensandPlus and LayneOx™ for the treatment of iron and manganese at the Maher WTP. The pilot testing determined the effectiveness of the treatment processes for reducing the contaminants to below levels established by State and Federal agencies. This pilot test report contains a detailed evaluation of the pressure filtration pilot test processes.

The GreensandPlus and LayneOx™ pilot test was performed from July 17, 2017 to August 4, 2017. An acclimation trial was completed from July 17, 2017 through July 18, 2017 using raw water from Maher Well No. 3. During this time, chemical pretreatment doses were optimized, and the filter media was allowed to acclimate to the pretreated raw water. Maher Well Nos. 1 and 2 were started on July 19, 2017 making all sources available for utilization. A total of nine trials were completed using GreensandPlus and LayneOx™ media. The blended sources utilized by trial are summarized in the Pilot Study Report - Blueleaf, Inc. (Blueleaf Report), Table No. 2.05: Filter Operation Summary in Appendix C.

4.2 Time Period/Duration

Blueleaf operated four filters for the pilot test, two with Greensand Plus and two with LayneOx™, in parallel. Nine filter trials were conducted on each of the four filters for a total of 36 individual filter trials, intended to determine optimal loading rates, chemical dosages, filter run times, finished water quality, and backwash water characterization. Pilot trials were conducted over a two-week period. The parameters monitored were flow rate, filter head loss and/or breakthrough, and chemical feed rates. Backwash water was analyzed to estimate settling characteristics, total suspended solids, and volume in order to determine size of the recycle/detention tanks.

4.3 Raw Water Pretreatment

Chemical pretreatment of the raw water was required for iron and manganese removal. A dose of sodium hypochlorite was injected into the raw water for oxidation and to produce a residual in the treated water. Sodium hypochlorite provided continuous regeneration of the media. The target pH to be maintained during the pilot study was 6.8 for filter effluents. The typical raw water pH from the Maher Wells was between 5.67 and 6.03, which is not within the recommended range of 6.2 to 8.5 for GreensandPlus filtration. Therefore, as conducted normally at the existing facility, the raw water pH was adjusted. Potassium hydroxide was injected into the raw water for pH adjustment during pilot testing. Although LayneOx™ media is not affected by pH and does not require chemical pretreatment for pH adjustment, the raw water flow into the LayneOx™ filters included potassium hydroxide. This is because the same pretreated raw water that was utilized for GreensandPlus was also utilized for LayneOx™, since the filters operated in parallel.

Chemical metering pumps with adjustable feed rate control were used to feed the treatment chemicals in liquid form, into the raw water supply line to the filters. The pretreatment chemicals were diluted with pilot filter effluent at measured volumetric ratios to produce chemical feed stocks with the desired concentrations. Chemical pretreatment doses were calculated based on chemical usage by monitoring the day tank volumes, or by using pump feed rate settings. The target effluent chlorine residual was 0.5 parts per million (ppm). The chemical doses used for the pilot testing are summarized in Table No. 3.06: Iron and Manganese Removal Pretreatment Doses in the Blueleaf Report.

Samples of chemically pretreated raw water were collected downstream of the chemical injection locations, and upstream of the filters to monitor total chlorine, free chlorine, and pH. Results from field analysis for these parameters is summarized in Table No. 3.07: Pretreated Water Samples, Field Analyses in the Blueleaf Report.

4.4 GreensandPlus Pilot Description

The GreensandPlus pilot unit design process parameters are presented in Table No. 4-1. The GreensandPlus process used a 12-inch layer of anthracite which acted as a physical filter for iron and manganese precipitated by the addition of the oxidant sodium hypochlorite. The next layer was oxide-coated sand media, which acted as a catalyst in the oxidation of the iron and manganese. The iron and manganese oxidized in this part of the process was then removed via adsorption or physical filtration.

Table No. 4-1
GreensandPlus Filtration Process Parameters

Name		Parameter
Number of Filters:		2
Filter Diameter:		6 in.
Filter Surface Area:		0.2 ft^2
Base Flow Rate:		0.8 – 1.2 gpm
Base Loading Rate:		4.0 – 6.4 gpm/ft^2
Media	Anthracite	12 in. depth
	Greensand Plus	24 in. depth
Theoretical Chlorine Dosage:		0.7 to 0.9 mg/l
Duration:		15 Days
Mode:		Continuous Regeneration

A detailed description of the pressure filtration pilot equipment and GreensandPlus process is provided in Sections 2.1.2 and 2.1.2.1 in the Blueleaf Report.

4.5 LayneOx™ Pilot Description

The manganese dioxide granular filter media pilot unit design process parameters are presented in Table No. 4-2. Sodium hypochlorite injection in the raw water stream

before the filter was used to oxidize the iron and manganese. Oxidized iron and manganese were removed by the physical filter properties of the media while iron and manganese that was not fully oxidized became catalytically precipitated and then adsorbed directly on the media.

Table No. 4-2
LayneOx™ Filtration Process Parameters

Name		Parameter
Number of Filters:		2
Filter Diameter:		6 in.
Filter Surface Area:		0.2 ft^2
Base Flow Rate:		0.8 - 1.2 gpm
Base Loading Rate:		4.0 - 6.4 gpm/ft^2
Media	LayneOx™	36 in. depth
	Mesh Size	20x40 US Sieve
Chlorine Dosage:		0.7 to 0.9 mg/l
Duration:		15 Days
Mode:		Continuous Regeneration

A detailed description of the pressure filtration pilot equipment and LayneOx™ process is provided in Sections 2.1.2 and 2.1.2.2 in the Blueleaf Report.

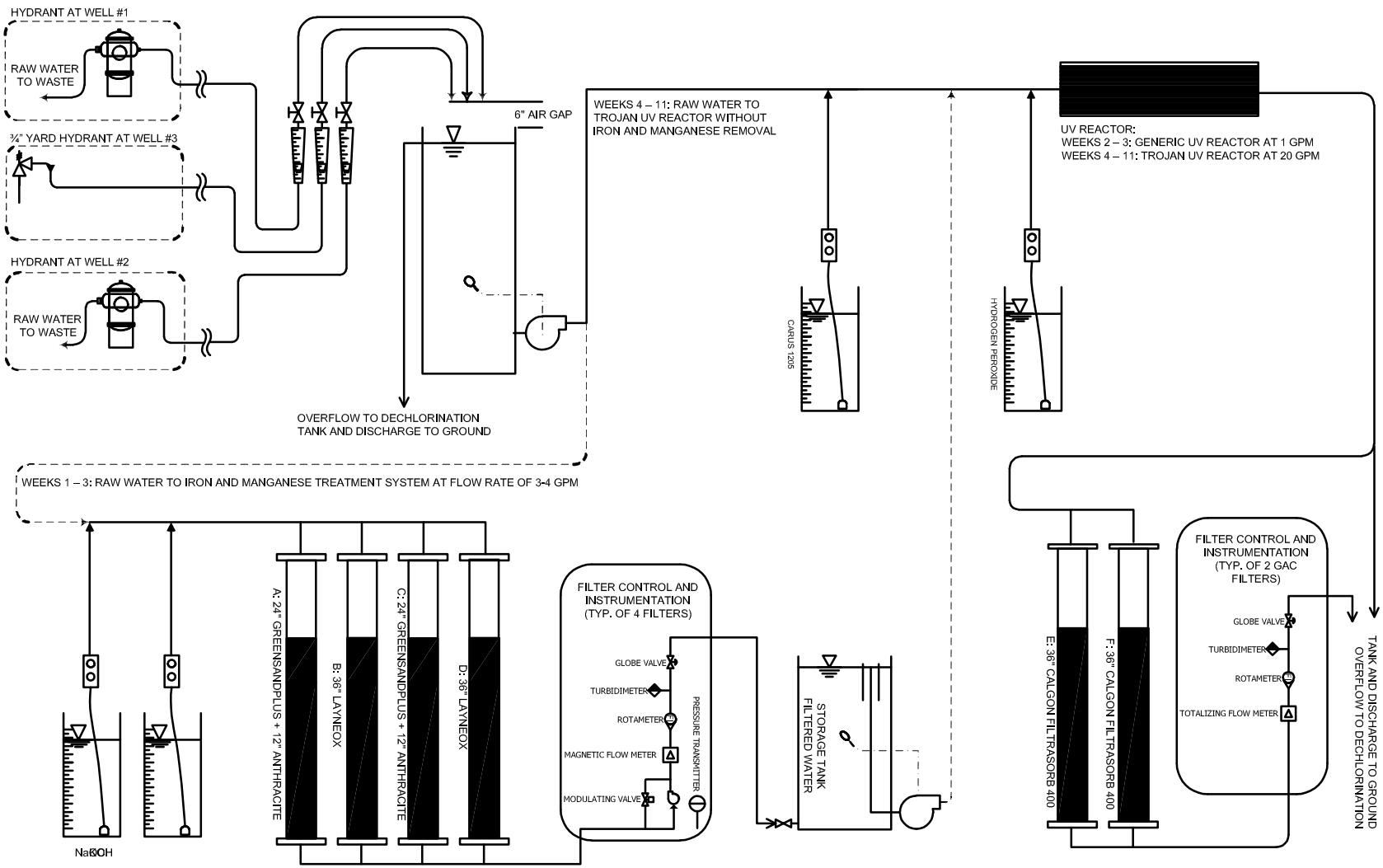
4.6 GreensandPlus and LayneOx™ Filtration Process

The GreensandPlus and LayneOx™ pilot processes, shown schematically in Figure No. 4-1, consisted of chemical oxidation and pH control, low head filtration and disinfection, monitoring equipment, and pilot scale backwashing pumps. The four filters provided approximately 0.2 square feet of surface area each. The target surface loading rate varied by each trial run, ranging from 4.0 gpm/sf and 6.4 gpm/sf. During most trial runs each pair of filters was operated with one at the lower loading rate and one at the higher loading rate. Trial runs on each filter were operated up to 70 hours, and were only shut down for scheduled changes in pilot system operation.

4.7 Water Quality Sampling Program

Pilot runs, and onsite sample analysis were performed by Blueleaf, Inc. using their own equipment for filter performance and chemical requirements. Samples were collected from the raw water, pretreated water, finished water during the pressure filtration pilot process.

In addition to raw water field tests, a total of 13 raw water samples were collected from the production wells and sent for analysis by a State Certified Laboratory, Alpha Analytical Laboratories (Alpha). Of the 13 raw water samples analyzed by Alpha, one was taken from filter trial run No. 5 and three were taken from filter trial run No. 9. One of the raw water samples taken during filter trial run No. 9 was taken for additional



TATA & HOWARD

PILOT SYSTEM SCHEMATIC

PILOT TEST REPORT

BARNSTABLE MA, DEPARTMENT OF PUBLIC WORKS

Figure No.

4-1

analysis and metal analysis. The raw water sample taken for additional analysis included analysis for following parameters: odor, color, carbon dioxide, total dissolved solids, cyanide, fluoride, nitrogen, nitrate, TOC, surfactants, MBAS, total coliform, Escherichia coli, chloride, sulfate, MBTE and hardness. The raw water sample taken for metal analysis include analysis for the following parameters: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, copper, magnesium, mercury, nickel, potassium, selenium, silver, sodium, thallium, and zinc. The results of the raw water laboratory analysis can be found in Table Nos. 3.03 through 3.05 in the Blueleaf Report.

One sample of pretreated water was collected from each trial of the pressure filtration pilot test and field analyzed for total chlorine, free chlorine, and pH. The results of field analysis of the pretreated water are included in Table No. 3.07: Pretreated Water Samples, Field Analysis in the Blueleaf Report.

An analysis was performed on each filter during each trial of the pressure filtration pilot test for filter operating conditions, hydraulic performance data, and filter effluent turbidity data. These parameters include trial duration, filter surface loading rate (FSLR), differential pressure versus runtime (slope, intercept, R-SQ – the coefficient of multiple determination for multiple regression), runtime to 10 psi, runtime breakthrough, all turbidity and representative turbidity data. The finished water analysis performance data is included in Table Nos. 3.09 through 3.12 in the Blueleaf Report.

One sample of finished water was collected from each filter during each trial of the pressure filtration pilot test and field analyzed for free chlorine residual, total chlorine residual, iron, manganese, and pH. The results of the field analysis are included in Table Nos. 3.13 through 3.16 of the Blueleaf Report. In addition, ten samples were collected and analyzed by Alpha for the same parameters. Two samples were taken from Trial No. 5 (Filters A and C), and eight samples were taken from Trial No. 9 (three from Filter A, one from Filter B, three from Filter C, and one from Filter D). The sample results are included in Table No. 3.17: Filter Effluent Water Quality Results by Lab Analysis, of the Blueleaf Report.

Similar to the raw water field tests, one filtered effluent water quality sample was taken from Trial No. 9 and analyzed for additional analysis. The additional analysis included true color, apparent color, TOC, DOC, total coliform, Escherichia Coli, carbon dioxide, nitrogen, nitrate, chloride, sulfate, aluminum, calcium, copper, sodium, hardness, and bromate. The results of this analysis are included in Table No. 3.18: Filter Effluent Water Quality Results – Additional Analysis in the Blueleaf Report.

The pressure filtration process also included sampling for disinfection byproducts and backwash water parameters. Disinfection byproduct results were analyzed on two filters from Trial No. 9 (Filters B and D), as presented in Table No. 3.19: Disinfection By-Product Results from Laboratory Analysis of the Blueleaf Report. The backwash water was sampled for iron, total iron, manganese, total manganese, TSS, and chlorine residual as presented in Table Nos. 3.20 through 3.22 in the Blueleaf Report.

Section 5

TATA & HOWARD

SECTION 5 – REMOVAL OF 1,4-DIOXANE

5.1 General

Blueleaf, Inc. also conducted pilot testing of advanced oxidation for the treatment of 1,4-Dioxane from source waters at the Maher Wells. The pilot testing determined the effectiveness of the treatment process for reducing 1,4-Dioxane to below action levels established by State and Federal agencies. This section of the pilot test report includes a detailed evaluation of the advanced oxidation pilot testing process.

The advanced oxidation pilot test was performed from July 24, 2017 through September 29, 2017, and was completed in two phases. Phase 1 included a small scale generic UV system that utilized filtered effluent from the pressure filtration pilot. Phase 2 utilized a larger UV system manufactured by Trojan Technologies (Trojan) to treat combined raw water from Maher Well Nos. 1 and 2, without the pressure filtration pilot process. Phase 2 included two trials described later in this section.

The raw water samples taken from the trial runs show that the highest concentration of 1,4-dioxane was 0.661 µg/L. Raw water quality sample results are summarized in Table No. 3.03 in the Blueleaf, Inc. Pilot Test Report in Appendix C.

5.2 Time Period/Duration

Phase 1 of the Advanced Oxidation pilot test operated for two weeks (July 24, 2017 through August 4, 2017), concurrent with the pressure filtration pilot process trials. Phase 2 operated over an eight week period (August 7, 2017 through September 29, 2017) without filtered effluent from the pressure filtration pilot system. The operating conditions monitored included flow rate, influent ultraviolet transmittance (UVT), ballast power level, pretreatment doses and concentrations, and contaminant levels, and the parameters sampled include hydrogen peroxide dose, iron, manganese, 1,4-dioxane, PFOS/PFOA, and bromate.

5.3 Raw Water Pretreatment

Chemical pretreatment of the filter effluent from the pressure filtration pilot process was required to complete the oxidation process during the advanced oxidation pilot test. Hydrogen peroxide was injected into the water prior to the UV reactor during both phases.

During Phase 2, the target hydrogen peroxide dose was 5 ppm for the first five weeks (trial 1). The hydrogen peroxide dose was reduced to 1 ppm for the remaining three weeks in an effort to optimize the treatment (trial 2). The target hydrogen peroxide dose and measured dose are included in Table 3.08: 1,4-Dioxane Removal Pretreatment Doses, in the Blueleaf Report. In addition, a sequestering agent provided by the Town (Carus 1205) was utilized to maintain iron and manganese in solution during all eight weeks of

the second phase. The target dose of Carus 1205 was 1.75 ppm to match the existing dosage.

5.4 Advanced Oxidation Pilot Description

The advanced oxidation pilot unit design process parameters are presented in Table No. 5-1. Phase 1 utilized a generic UV reactor to meet the minimal flow requirements associated with iron and manganese removal process. Phase 2 utilized a TrojanUVPhox™ 12AL30 UV-Oxidation System (Trojan System), provided by Trojan Technologies. The Trojan System was used during the pilot runs without iron and manganese removal, where higher flows are permissible. The Trojan system was also equipped with wipers to clean potential buildup of residue on the lamp sleeves. The wipers were set to operate at a frequency of every two hours during the pilot test.

Table No. 5-1
Advanced Oxidation Process Parameters

Name		Parameter
Generic UV System:		
	Length	15-inches
	Circumference	4.25-inches
	Ballast	120V 50/60 Hz
Trojan UV System:		
	Length	76-inches
	Diameter	12-inches
	Amalgam Lamps	12

A detailed description of the advanced oxidation pilot equipment and process is provided in Sections 2.1.3 through 2.1.3.2 in the Blueleaf Report.

5.5 Advanced Oxidation Process

Pilot scale advanced oxidation process equipment was provided for 1,4-dioxane removal. Phase 1 of the process utilized a small generic UV reactor. Filter effluent from the pressure filtration pilot process was chemically pretreated as previously discussed, and entered the stainless-steel disinfection chamber where the water was exposed to the UV lamps. The exposure time is a function of the flow rate, and the UV dosage is the product of the ultraviolet intensity and the exposure time within the chamber. The flow rate for Phase 1 was 4.0 gpm, with 100 percent ballast power level and hydrogen peroxide pretreatment dose of 5.0 ppm.

Phase 2 utilized the Trojan UV system. Filter effluent from the pressure filtration pilot process was chemically pretreated as previously discussed, and entered the Trojan system where it was exposed to 12 amalgam lamps contained in transparent sleeves. Phase 2 included two pretreatment trials, both with flow rates of 20.0 gpm. Trial 1 included a 100

percent ballast power level, 5.0 ppm hydrogen peroxide dose and 1.75 ppm sequestering agent (Carus 1205) dose. Trial 2 included a 60 percent ballast power level, 1.0 ppm hydrogen peroxide dose and 1.75 ppm sequestering agent dose. One UV sleeve was inspected for fouling on a weekly basis. The same sleeve was inspected each week.

Finally, the processed water exited the UV reactor and entered the GAC filters for PFOS/PFOA removal and quenching of residual hydrogen peroxide from the advanced oxidation process.

The advanced oxidation pilot testing processes are shown schematically in Figure No. 4-1.

5.6 Water Quality Sampling Program

Pilot testing runs, and onsite sample analysis were performed by Blueleaf, Inc. using their own equipment for process performance and chemical requirements. Samples were collected from the raw water, pretreated water, and finished water (after advanced oxidation and after GAC treatment) during the advanced oxidation pilot process.

A total of 11 raw water samples (two from Phase 1 and nine from Phase 2) were taken and delivered to Alpha Analytical Laboratories for 1,4-dioxane analysis. The results of the laboratory analyses are included in Table No. 3.03 in the Blueleaf Report.

One sample of pretreated water was collected each week (8 total) during Phase 2 (Trojan UV reactor) of the advanced oxidation process and analyzed for hydrogen peroxide concentration to monitor the target concentration of hydrogen peroxide. Results of the pretreated water analysis are included in Table No. 3.08: 1,4-Dioxane Removal Pretreatment Doses in the Blueleaf Report.

An analysis was performed from each trial for the following operating conditions: flow rate, influent UVT, ballast power level, and pretreatment doses. The finished water analysis operating conditions data is included in Table 3.24: Advanced Oxidation Process with UV – Operating Conditions in the Blueleaf Report.

One sample of finished water was collected from each week during each phase of the advanced oxidation pilot test and analyzed for water quality parameters. These parameters included 1,4-dioxane, PFOS/PFOA, hydrogen peroxide concentration (Phase 2 only), iron and manganese (Phase 2 only), and bromate (Phase 2 only). The results are presented in Table No. 3.25: Advanced Oxidation Process with UV Effluent – Field and Lab Water Quality Data in the Blueleaf Report.

5.7 1,4 Dioxane Removal with GAC Contactor

At the conclusion of the pilot test, further testing was conducted for a duration of four weeks where the sole operating equipment included a single carbon filter with virgin media and raw water from the wells running through the filter. Sampling for 1,4 dioxane

occurred at 10-day increments during the piloting period at influent and effluent water locations beginning the day of pilot equipment set-up and concluding four weeks later. Samples were delivered to Alpha Analytical Laboratories for analysis. This provided quantitative data relative to the adsorption and subsequent desorption of 1,4 dioxane from the carbon media without advanced oxidation treatment. A detailed description of the pilot equipment and laboratory results for 1,4 dioxane are included in the Blueleaf letter report in Appendix E. Further discussion is provided in Section 7.5 of this report.

Section 6

TATA & HOWARD

SECTION 6 – REMOVAL OF PFOS/PFOA

6.1 General

Blueleaf, Inc. also conducted pilot testing of GAC filtration for the removal of PFOS/PFOA. The pilot testing determined the effectiveness of the treatment process for reducing the contaminants to below action levels established by State and Federal agencies. This section of the pilot test report contains a detailed evaluation of the GAC pilot process.

6.2 Time Period/Duration

The GAC pilot test was performed from July 24, 2017 through September 29, 2017, during both phases of the advanced oxidation pilot test (Phase 1 with iron and manganese removal and Phase 2 with iron and manganese sequestering). The operating conditions monitored were nominal flow rate, empty bed contact time (EBCT) (minutes), cumulative flow, average influent PFOS/PFOA concentration, and total PFOS/PFOA mass. The parameters sampled include 1,4-dioxane, PFOS/PFOA, bromate (Phase 2 only), and iron and manganese (Phase 2 only).

6.3 GAC Pilot Description

The GAC pilot unit design process parameters are presented in Table No. 6-1. The GAC contactors included equipment for flow control, two contactors operating in parallel, data acquisition system, and sample points for all relevant sample streams. No additional chemical pretreatment was introduced between the UV treatment and GAC contactors. Oxidation is not required for the adsorption of PFOS/PFOA into the GAC media. The GAC filters also provide a secondary function of quenching any residual hydrogen peroxide from the Advanced Oxidation process.

Table No. 6-1
Granular Activated Carbon Filtration Process Parameters

Name		Parameter
Number of Filters:		2
Filter Diameter:		6 in.
Contactor Length:		60 in.
Filter Cross-Sectional Area:		0.2 ft^2
Flow Rate:		0.4 gpm
Media:	GAC	3 ft. depth

A detailed description of the GAC pilot equipment and process is provided in Section 2.1.4 in the Blueleaf Report in Appendix C.

6.4 GAC Filtration Process

Effluent water from the Advanced Oxidation pilot test entered the contactor units that contain 36-inches of Calgon FILTRASORB 400 media (bituminous coal-based). PFOS/PFOA was removed through absorption by the contactor media. Backwashing of the contactors was not required during the pilot study. The nominal flow rate was 0.4 gpm, and the EBCT was 11 minutes for both phases. The cumulative flow under Phase 1 was 5,760 gallons, and 30,528 gallons under Phase 2.

The GAC filtration pilot testing process is shown schematically in Figure No. 4-1.

6.5 Water Quality Sampling Program

Pilot testing runs, and onsite sample analysis were performed by Blueleaf, Inc. using their own equipment for process performance and chemical requirements. Samples were collected from the raw water and finished water during the advanced oxidation/GAC filtration pilot process.

A total of 12 raw water samples were taken and delivered to Alpha Analytical Laboratories for analysis of PFOS/PFOA. Three samples were taken during Phase 1 of the advanced oxidation/GAC filtration process. One sample was taken during Trial 5 of the pressure filtration pilot process, and two were taken from Trial 9 of the pressure filtration pilot process. The remaining nine raw water samples were taken during Phase 2 of the advanced oxidation/GAC filtration process, without filtered effluent water from the pressure filtration pilot process. The results of the raw water laboratory analysis are included in Table No. 3.03 in the Blueleaf Report.

An analysis was performed from each phase of the advanced oxidation/GAC filtration process pilot test for the following operating conditions: nominal flow rate, EBCT, cumulative flow rate, average influent concentration, and total contaminant mass. The finished water operation conditions data is included in Table 3.26: GAC Contactor Operating Conditions in the Blueleaf Report.

One sample of finished water was collected each week of GAC pilot test and analyzed for water quality parameters. These parameters included 1,4-dioxane, PFOS/PFOA, bromate (Phase 2 only), and iron and manganese (Phase 2 only). The results are presented in Table No. 3.27: GAC Contactor Effluent – Lab Water Quality Data in the Blueleaf Report.

Section 7

TATA & HOWARD

SECTION 7 – DISCUSSION OF RESULTS

7.1 General

This section provides a discussion of the results obtained from pilot testing the GreensandPlus, LayneOx™, Advanced Oxidation, and Granulated Activated Carbon (GAC) filtration treatment processes. A portion of the water quality testing was conducted in the field, and the sample results are included in Appendix A of the Blueleaf Report. Details on the field analytical methods used for water quality testing are included in Section 2.3 of the Blueleaf, Report. Samples were also collected in laboratory prepared sample bottles and delivered to Alpha Analytical Laboratories (Alpha) in Westborough, MA. The certified laboratory results are included in Appendix B of the Blueleaf Report in Appendix C. A discussion of these results and analysis are presented in this section.

7.2 Raw Water Quality Results

Raw water samples taken from individual wells and combinations of wells indicated median raw water iron concentrations ranging from 0.04 mg/L to 0.51 mg/L. Median raw water manganese concentrations from individual wells and combinations of wells ranged from 0.045 mg/L to 0.154 mg/L. The median raw water pH was between 5.67 and 6.03. Raw water quality sample results are summarized in Table No. 3.02: Raw Water Quality from Field Analysis of the Blueleaf Report.

Raw water samples from the GreensandPlus and LayneOx™ filter systems were taken during the filter runs for iron, manganese, and pH. Raw water samples were also taken during the Advanced Oxidation and GAC process for 1,4-dioxane and PFOS/PFOA, as identified in Sections 5 and 6 (respectively) of this report. Raw water quality results from all processes are included in Section 3.1 of the Blueleaf Report.

During the advanced oxidation pilot testing, the median raw water 1,4-dioxane concentration was approximately 0.50 µg/L. Raw water PFOS+PFOA concentrations averaged approximately 95 nanograms per liter (ng/L) during the GAC pilot test.

7.3 Iron and Manganese Removal

The objective of the pressure filtration with adsorptive media pilot test was to determine the effectiveness of the treatment processes for reducing iron and manganese to below levels established by State and Federal agencies. Filter effluent data was evaluated by media type, and filter loading rate.

Both GreensandPlus and LayneOx™ were capable of removing iron and manganese to concentrations below the respective SMCLs of 0.3 mg/L and 0.05 mg/L. The results from the pressure filtration pilot test show that the average influent iron concentration of 0.089 mg/L was reduced to below 0.05 mg/L by oxidation with NaOCl with either GreesandPlus or LayneOx™ medias (all four filters). The average influent manganese

concentration of 0.081 mg/L (above the SMCL) was reduced to below 0.01 mg/L in all four filters. The filtered water quality test results are presented in Tables 3.13 through 3.16 in the Blueleaf Report in Appendix C. In addition, the iron and manganese removal by GreensandPlus and LayneOx^{TM} were similarly effective based on comparison of the iron and manganese effluent data, as discussed in Section 4.2.3 of the Blueleaf Report.

Filter run times were limited by the pilot schedule and not terminal headloss or contaminant breakthrough during the pilot study. Filter run times of over 70 hours were completed while operating at target loading rates of 4 and 6 gpm/sf before being shut down for scheduled changes. It is unknown whether headloss or breakthrough would be the limiting factor if the filters were operated beyond 70 hours. Based on the raw iron and manganese concentrations, and oxidation with sodium hypochlorite, filter run times in excess of 24 hours should be expected for the piloted filter surface loading rates of 4 to 6.4 gpm/sf.

In the absence of pressure filtration with either GreensandPlus or LayneOx^{TM} medias, iron was oxidized and removed by the GAC contactors during the pilot test. Hydrogen peroxide from the advanced oxidation process acted as a strong oxidizer thereby, allowing the iron to easily convert from a soluble to insoluble state leading to removal of iron by the GAC contactors. Iron does not adsorb to the carbon media, which allows it to accumulate on the surface of the media enabling it to be removed by backwashing. Based on the results of the pilot testing, iron will continue to be oxidized by hydrogen peroxide with the continued use of an iron and manganese sequestering agent.

Results from pilot testing indicated that in the absence of pressure filtration for iron and manganese removal, manganese passed through the GAC contactors in the soluble state. This was noted based on similar effluent manganese results during pilot testing from the advanced oxidation processes (Table No. 3.25 in the Blueleaf Report) as compared to the effluent manganese results from the GAC contactors (Table No. 3.27 in the Blueleaf Report). The hydrogen peroxide dosage required for the advanced oxidation process along with the associated contact time is not sufficient to completely oxidize manganese and allow for removal of manganese by the GAC contactors. As previously stated, the GAC media quenches residual hydrogen peroxide, which should prevent further oxidation of manganese within the water distribution system beyond what occurs within the GAC contactors. Based on observations during pilot testing, the use of hydrogen peroxide as a strong oxidizer with advanced oxidation treatment should not create turbid water as a result of sequestered manganese.

7.4 1,4-Dioxane Removal Using Advanced Oxidation

The objective of the advanced oxidation pilot test runs was to determine the effectiveness of the treatment processes for reducing 1,4 dioxane to below levels established by State and Federal agencies. The small generic UV system and large Trojan UV system were evaluated independently.

The raw water 1,4 dioxane concentration ranged from 0.4 to 0.7 µg/L and had a UV transmittance of 99.7%. The advanced oxidation pilot test with the small generic UV system produced 1,4-dioxane concentrations of 0.691 and 0.663 µg/L, which are well above the regulatory limit of 0.3 µg/L. Based on these concentrations, the small generic UV system was not successful in removing 1,4-dioxane likely due to insufficient lamp power necessary for the advanced oxidation process. Conversely, the large Trojan UV system was effective in the destruction of 1,4 dioxane to below the regulatory limit of 0.3 µg/L. Effective advanced oxidation treatment was achieved with two different peroxide (H_2O_2) doses and ballast power level combinations, specifically 5 ppm of H_2O_2 and 100% BPL, and 1 ppm of H_2O_2 and 60% BPL, with both scenarios operating at 20 gpm. All laboratory results from the advanced oxidation pilot test with the large Trojan UV system were below the laboratory detection limit of 0.144 µg/L and are provided in Table 3.25 in the Blueleaf Report.

Each week during the Trojan UV system pilot test during which Fe/Mn removal was not piloted, the UV system was shut down and one of the 12 lamp sleeves was removed for visual inspection of potential fouling. The same lamp sleeve was inspected each week. The inspections show there was no visual indication of fouling throughout the study.

Appendix D includes a pilot test report prepared by Trojan UV. Section 5.1.2 of the Trojan UV report includes conclusions regarding quartz sleeve fouling based on a sample sleeve removed from the UV pilot reactor at the conclusion of the study, and mailed to Trojan UV for analysis. The fouling factor calculated using the sample pilot sleeve and new sleeve was 0.94. A third party was retained by Trojan UV and provided an approved sleeve fouling factor of 0.95, similar to that determined by Trojan UV. However, it should be noted that the pilot fouling result is likely biased due to the small sample size and that the pilot fouling result may have been greater than 0.95, since the third-party fouling test was conducted in poorer water quality (secondary wastewater effluent). Further detail is provided in section 5.1.2 of the Trojan UV report.

Details from Trojan UV's report indicate that the results from three raw water samples analyzed by Trojan UV show low hydroxyl radical scavenging demand in the water, which is favourable for UV-AOP. All three samples had a low absorbance in the 200-300 nm range, with UVT values of 98-99% (254 nm, 1/cm). Also, the alkalinity level in the raw water is low, which is ideal for the advanced oxidation process. Trojan UV also characterized the total iron and manganese levels as low, with maximum values of 0.12 and 0.053 mg/L, respectively. These metals are generally associated with fouling of the quartz UV lamp sleeves thus, the low presence of these constituents is favorable for the UV process.

7.5 1,4-Dioxane Removal with GAC Contractor

During Phase 1 of the advanced oxidation pilot testing, the small generic UV reactor was not effective in the destruction of 1,4 dioxane. During the two-week duration of Phase 1 of the advanced oxidation pilot testing, the laboratory data indicated that the raw 1,4 dioxane levels of 0.6 ppb were passing through the UV system without treatment, and

approximately half was removed after passing through the downstream GAC filters. Upon startup of the Trojan system, 1,4 dioxane was destroyed by the UV but was detected after GAC filtration. The advanced oxidation process (AOP) water was desorbing the 1,4 dioxane from the GAC media that accumulated during use of the ineffective small generic UV system.

1,4 dioxane is weakly adsorbed by the GAC and easily desorbs off the carbon media over time. Since it is weakly adsorbed, the mass transfer zone is a larger proportion of the media bed, so there is a minimal amount of fresh carbon to catch the 1,4 dioxane. In addition to desorption, the 1,4 dioxane removal would likely last only a few days. Desorption would only occur if the water quality has lower PFOS/PFOA concentration than initially applied, and if the concentration is steady, GAC will reach the saturation point, thereby discontinuing adsorption and desorption and the contaminant will pass through the media. The capacity of GAC for 1,4 dioxane removal is extremely low and will be exhausted quickly even if there are trace amounts reaching the carbon filter bed. Based on discussions with GAC vendors, the expectation is that there should not be enough 1,4 dioxane loaded on the GAC media to desorb as a large slug in the future.

As discussed in Section 5.7 of this report, additional pilot testing occurred to quantify the adsorption and subsequent desorption of 1,4 dioxane from the carbon media without advanced oxidation. Following the four-week pilot testing period, the data indicated that the raw water concentration of 1,4 dioxane was reduced to below detection limits in the sample at pilot start up and after nine days of operation. Samples collected after 20 and 28 days of pilot operation indicated no 1.4 dioxane removal through the carbon filter and possible desorbing of 1,4 dioxane from the media as effluent concentrations exceeded raw water concentrations in both samples. Influent and effluent 1,4 dioxane concentrations in the Day 20 samples were 0.309 µg/L and 0.378 µg/L, respectively and concentrations in the Day 28 samples were 0.325 µg/L and 0.349 µg/L, respectively. The samples indicated no removal of 1,4 dioxane through the carbon media and possible desorbing of 1,4 dioxane as the effluent results were slightly higher than the influent results. The data from Day 20 and 28 samples also suggests that desorbing of 1,4 dioxane from the carbon media reached a peak between Days 20 and 28 and was approaching the point where influent concentration would equal effluent concentration.

Influent and effluent 1,4 dioxane concentrations during the extended pilot testing summarized in this section are shown in Table 1 in the Blueleaf letter report in Appendix E.

7.6 PFOS/PFOA Removal

The objective of the GAC pilot test runs was to determine the effectiveness of the treatment processes for reducing PFOS/PFOA to below levels established by State and Federal agencies. In addition, the hydraulic performance of the GAC contactors were evaluated and an assessment was completed to determine if the GAC contactors were impacted by 1,4-dioxane.

The raw water PFOS/PFOA concentrations ranged from 80 to 120 ng/L. Results of the GAC pilot test runs show that the contactors were capable of removing PFOS/PFOA to non-detectable levels in all laboratory analyzed samples. All laboratory results from the GAC pilot test are provided in Table 3.27 in the Blueleaf Report.

Hydraulic performance data was only obtained during trial two of the GAC pilot test due to malfunction of the GAC data logger during trial one. Although a set point of 0.4 gpm was established to maintain the specified EBCT of 11 minutes, the actual flow rate fluctuated during the course of Phase 2 such that the actual EBCT ranged from 9 – 13 minutes.

The GAC media developed some headloss during the extended run pilot testing. In general, headloss would increase by 2 – 3 psi per week during the extended run. After the system was shut down for UV lamp inspection every week, the system would return to the initial headloss conditions. It appears that the headloss was due to media compaction over time and that the media filter relaxed during the weekly shutdown. There was no evidence of iron removal based on water quality data, and some visual accumulation at the surface of the media. However, the differential pressure never approached 10 psi, which would initiate backwash. Therefore, the contactors were never backwashed. The contactor effluent turbidity remained below 0.1 NTU throughout Phase 2.

As stated, the small generic UV Advanced Oxidation system was not effective in the destruction of 1,4-dioxane. Therefore, the GAC contactors were exposed to raw concentrations of 1,4-dioxane during Phase 1. As shown in Table No. 4.04: 1,4-Dioxane Data Through the UV/GAC Train from the Blueleaf Report, the concentration of 1,4-dioxane was reduced by half in the GAC contactors during Phase 1 of the GAC pilot test. During Phase 2 of the GAC pilot test, the GAC contactors were exposed to water that had successfully destructed 1,4-dioxane via the Trojan system of advanced oxidation. The results presented in Table No. 4.04 of the Blueleaf Report also show that the treated water under the Phase 2 advanced oxidation process desorbed the 1,4-dioxane, which had previously accumulated in the GAC filters. Concentrations of 1,4-dioxane was reported at non-detectable levels for the remainder of the study.

Section 8

TATA & HOWARD

SECTION 8 – COST ANALYSIS

8.1 General

The cost analysis in this section includes total estimated capital costs for two options. Option No. 1 includes 1,4 dioxane removal, and PFOS/PFOA removal only, and Option No. 2, which includes iron and manganese removal, 1,4 dioxane removal, and PFOS/PFOA removal. Also included are costs for future addition of greensand filtration for iron and manganese removal (within five years of completion of the filtration plant) if Option No. 1 is implemented by the Town. The cost analysis also includes estimated first year operation and maintenance costs for both options.

It should be noted that a 66' x 95' metal building is included with both Option No. 1 (no greensand filtration) and Option No. 2 (implementation of all treatment processes). In order to provide a smaller building layout that does not enclose a potential future location for greensand filters, a custom 54' x 66' metal building with 33' x 41' module (L-shaped building) would be required. The capital cost for this custom building would be approximately 10% higher than the capital cost of a standard 66' x 95' metal building design.

8.2 Option No. 1 - Metal Building, Advanced Oxidation, GAC Filtration

Table No. 8-1 summarizes the total estimated capital costs for implementation of Option No. 1, which includes a 66' x 95' metal building, advanced oxidation and GAC filtration equipment and all appurtenances, chemical feed equipment, residuals management, site work, concrete work, electrical, instrumentation, mechanical, plumbing, fire protection, contractor overhead and profit, an escalation factor of 2.5-percent to the midpoint of construction in 2019, engineering, and contingency. The total estimated capital cost for Option No. 1 is $7,615,000.

Table No. 8-1
Total Estimated Capital Costs – Option No. 1 – Metal Building, Advanced Oxidation, and GAC Filtration

Description	Estimated Cost
66’ x 95’ Metal Building, Mechanical, Doors and Windows, Roofing, Waterproofing, Finishes, Specialties	$870,000
Foundation and Backwash Tank	$495,000
Site Work	$210,000
Advanced Oxidation Equipment and Appurtenances	$700,000
Granular Activated Carbon Filtration Equipment and Appurtenances	$1,200,000
Floating Supernatant Water and Sludge Pumps	$65,000
Chemical Feed Equipment	$100,000
Electrical with Service Upgrade	$560,000
Emergency Generators	$355,000
Instrumentation, SCADA, Integration	$160,000
Subtotal	$4,715,000
Escalation to Midpoint of Construction (2.5%)	$120,000
Contractor Overhead & Profit (15%)	$715,000
General Conditions, Bonds, Insurance	$550,000
Engineering (Design, Permitting, Bidding, Construction Services) and Contingency (25%)	$1,515,000
TOTAL ESTIMATED PROJECT COST	$7,615,000

8.3 Option No. 2 - Metal Building, Greensand Filtration, Advanced Oxidation, GAC Filtration

Table No. 8-2 summarizes the total estimated capital costs for implementation of Option No. 2, which includes a 66’ x 95’ metal building, greensand filtration, advanced oxidation, and GAC filtration equipment and all appurtenances, chemical feed equipment, residuals management, site work, concrete work, electrical, instrumentation, mechanical, plumbing, fire protection, contractor overhead and profit, an escalation factor of 2.5-percent to the midpoint of construction in 2019, engineering, and contingency. The total estimated capital cost for Option No. 2 is $9,970,000.

Table No. 8-2
Total Estimated Capital Costs – Option No. 2 – Metal Building, Greensand Filtration, Advanced Oxidation, and GAC Filtration

Description	Estimated Cost
66' x 95' Metal Building, Mechanical, Doors and Windows, Roofing, Waterproofing, Finishes, Specialties	$870,000
Foundation and Backwash Tank	$495,000
Site Work	$210,000
Greensand Filtration Equipment and Appurtenances	$1,200,000
Advanced Oxidation Equipment and Appurtenances	$700,000
Granular Activated Carbon Filtration Equipment and Appurtenances	$1,200,000
Floating Supernatant Water and Sludge Pumps	$65,000
Chemical Feed Equipment	$100,000
Electrical with Service Upgrade	$740,000
Emergency Generators	$355,000
Instrumentation, SCADA, Integration	$215,000
Subtotal	$6,150,000
Escalation to Midpoint of Construction (2.5%)	$155,000
Contractor Overhead & Profit (15%)	$945,000
General Conditions, Bonds, Insurance	$725,000
Engineering (Design, Permitting, Bidding, Construction Services) and Contingency (25%)	$1,995,000
TOTAL ESTIMATED PROJECT COST	$9,970,000

8.4 Estimated Operation and Maintenance Costs

As is typical with any treatment facility, costs associated with the general operation and maintenance of the facility can be substantial. In order to review a representative overall cost of the new filtration plant, the O&M costs were evaluated and are presented herein.

Annual operation and maintenance (O&M) costs include fixed and flow-based costs. Fixed operating costs are those costs that are incurred in the operation of the Town facility and do not vary appreciably with flow. These costs include, but are not necessarily limited to the cost of power used to light, heat or cool the facility, insurance, maintenance of plant, equipment, and engineering. Flow based operating costs are those costs which are incurred in the operation of the new filtration plant and which vary depending upon the flow through the facility. These costs include, but are not necessarily limited to the cost of power used to operate water treatment facility equipment, chemicals used in water treatment, media replacements, UV lamp replacements, and the disposal of residuals. The first-year O&M cost includes the O&M costs for the existing Maher facilities plus the new, additional costs associated with the new filtration plant.

A summary of the estimated first year O&M cost is provided in Table No. 8-3 and Table No. 8-4, and described in further detail herein. As indicated, the total first year O&M cost for Option No. 1, based on an average daily flow rate of 1.0 mgd, is $320,000. The total first year O&M cost for Option No. 2, based on an average daily flow rate of 1.0 mgd, is $373,000.

- Electricity costs are based on estimated equipment horsepower requirements, kilowatt-hours of operation, and electricity unit costs based on the August 2016 electric bill for the facility. The flow-based electricity costs include the electricity associated with pumping, operation of the chemical feed equipment, HVAC, and operation of the UV reactor. Fixed-based electricity costs are associated with the use of the building (i.e., lights, HVAC, etc.).
- Chemical costs were included for sodium hydroxide, zinc orthophosphate, sodium hypochlorite, and hydrogen peroxide. Sodium hydroxide will be utilized for pH adjustment, zine orthophosphate for corrosion control, sodium hypochlorite for disinfection, and hydrogen peroxide for advanced oxidation to treat 1,4-dioxane. In Option 2, additional sodium hypochlorite will be required for oxidation of iron and manganese, but the blended phosphate chemical for sequestering will be eliminated. In Option No. 1, the blended phosphate chemical for sequestering iron and manganese will continue to be used.
- The Greensand Plus media replacement cost listed in Table No. 8-4 is an annualized cost for the media replacement based upon a media life of eight years and a total media replacement cost for the four greensand pressure vessels of approximately $320,000.
- Residuals disposal requires contracting with an experienced company specializing in waste disposal to pump the residuals from the bottom of the backwash water holding tank into a pumper truck to transport and dispose of the residuals off site. For the purposes of this evaluation, it was assumed that the residuals would be comprised of approximately 5% solids and would be disposed of at a cost of $0.20/gallon.
- It was assumed that natural gas would be utilized as the fuel for the emergency generators.
- A 5% allowance for building insurance and contingency is included in the annual O&M budget.

Table No. 8-3
Estimated First Year Operation and Maintenance Cost – Option No. 1 – Advanced Oxidation and GAC Filtration Only

Item	Estimated Annual Cost
Electric	$75,000
Chemicals	$40,000
GAC Media Replacement	$120,000
UV Lamp Replacement and Maintenance	$10,000
Equipment and Maintenance	$40,000
Residuals Removal	$5,000
Site	$2,500
Supplies	$2,500
Fuel	$10,000
Insurance and Contingency (5%)	$15,000
TOTAL	$320,000

Table No. 8-4
Estimated First Year Operation and Maintenance Cost – Option No. 2 – Greensand Filtration, Advanced Oxidation, and GAC Filtration

Item	Estimated Annual Cost
Electric	$80,000
Chemicals	$37,000
GAC Media Replacement	$100,000
Greensand Plus Media Replacement	$40,000
UV Lamp Replacement and Maintenance	$8,500
Equipment and Maintenance	$65,000
Residuals Removal	$10,000
Site	$2,500
Supplies	$2,500
Fuel	$10,000
Insurance and Contingency (5%)	$17,500
TOTAL	$373,000

8.5 Estimated Costs for Future Addition of Iron and Manganese Filtration

If the Town chooses to proceed with Option No. 1, capital costs to implement greensand filtration at the new facility at a future date (assumed Year 2024) will increase when compared to costs to implement greensand filtration present day.

The total estimated capital cost for the addition of greensand filtration in Year 2024 is $3,200,000. This is approximately $850,000 higher than the present-day capital cost to implement greensand filtration if Option No. 2 were implemented. The added cost includes annual cost increases of 5% for equipment and 3% for labor, contingency, and incidentals over the 5-year period from 2019 to 2024, additional contractor mobilization, and modifications to the building and newly constructed treatment processes to accommodate the addition of greensand filtration. Also included are costs for additional design, permitting, MassDEP approval, and bidding requirements.

Section 9

TATA & HOWARD

SECTION 9 – ADDITIONAL MASSDEP REQUIREMENTS

9.1 General

The MassDEP's approval of the pilot test proposal for this project included several specific conditions requiring evaluation and discussion within this report. These specific conditions include the following:

- Simultaneous compliance effects of the treated water with the existing conditions of the water distribution system and household plumbing, specifically historical lead and copper sampling, presence of the lead services, and the condition of chemical coating existing within the currently stable plumbing. In addition, a discussion of continuing compliance with other rules, including Revised Total Coliform Rule, Ground Water Rule, and Disinfections By-Products Rule.

- Evaluate the results of the pilot study following guidance contained in the EPA's "Optimal Corrosion Control Treatment Evaluation Technical Recommendations for Primacy Agencies and Public Water Systems", March 2016, publication number EPA 816-B-16-003.

- Discussion of information available from the vendor and the EPA's Treatability Database on the formation of oxidation by-products for 1,4 dioxane and perfluorinated compounds.

Details and discussions regarding these conditions are provided in Sections 9.2 through 9.4 below.

9.2 Lead and Copper Rule Compliance

The Hyannis Water System is currently required to complete lead and copper sampling in the water distribution system once every three years under the Lead and Copper Rule. The Hyannis Water System most recently conducted lead and copper sampling during the monitoring period of 6/1/2016 to 9/30/2016 within the compliance period of 1/1/2014 to 12/31/2016. A total of 35 samples were taken. The 90^{th} percentile results for lead were 0.00 mg/L. The 90^{th} percentile results for copper were 0.23 mg/L. No samples for either lead or copper were above the respective action levels. A copy of the System's most recent MassDEP Lead and Copper (LCR) Review Summary Sheet is included in Appendix F. There are no known lead water services within the Hyannis Water System water distribution system.

The proposed treatment systems included in this pilot test report should not change phosphate residual within the water distribution system. The chemical coating currently in place within the distribution system piping is firmly established due to prolonged use of zinc orthophosphate for corrosion control at the existing Maher facility. The Town routinely monitors phosphate levels within the water distribution system to confirm that residual phosphate is maintained at the desired levels for proper corrosion control. No

changes to the current treatment processes at the Maher facility are proposed as part of the treatment system upgrades.

The facility is currently in compliance with the Total Coliform Rule, Ground Water Rule, and Disinfection By-Products Rule. It is expected that compliance with these rules will be enhanced by the addition of the proposed treatment processes with no unintended consequences.

9.3 EPA Publication Number 816-B-16-003

The EPA's publication "Optimal Corrosion Control Treatment Evaluation Technical Recommendations for Primacy Agencies and Public Water Systems", March 2016, publication number EPA 816-B-16-003, was reviewed as part of this evaluation. Section 6.3 – Impacts to Treatment Changes in EPA publication, references corrosion control treatment, disinfection, and filtration, which are currently provided or proposed at the Maher facility.

Current corrosion control treatment at the facility utilizes zinc orthophosphate. The same corrosion control will remain in place once the new advanced oxidation, GAC filtration processes, and greensand filtration (potential future addition) are added to the facility. It is anticipated that the current finished water pH at the facility (without the use of the Yarmouth emergency interconnection) of 7.5 will be maintained once the new treatment processes are in place as pH adjustment is provided in the facility.

The existing Maher facility currently uses sodium hypochlorite for drinking water disinfection. Sodium hypochlorite is a base, which can increase the pH of the water thereby, lowering the corrosivity of the water. The current treatment methodology at the facility using sodium hypochlorite for disinfection will continue to be utilized once all new treatment processes are implemented.

The existing on site concrete water storage tank provides contact time for disinfection of potable water at the Maher facility. The contact time is sufficient to meet 4-log disinfection requirements, if needed at the facility in the future under the Ground Water Rule.

In general, greensand filtration and GAC filtration will not lower the pH of the treated water. The introduction of zinc orthophosphate for corrosion control will occur post-treatment where adjustments to the dosage can occur, if required, to meet the facility's optimal effluent corrosion control requirement.

9.4 Oxidation Byproducts for 1,4 Dioxane and Perfluorinated Compounds

The advanced oxidation process with hydrogen peroxide for 1,4 dioxane removal has the potential to create bromate as a byproduct of treatment. Bromate monitoring occurred during the extended run pilot test using the Trojan UV advanced oxidation equipment with hydrogen peroxide and GAC contactors. A total of eight samples were taken for

bromate analysis between August 7, 2017 and September 20, 2017. All eight bromate samples yielded non-detect (ND < 1.0 µg/l) results. Table No. 3.25: Advanced Oxidation Process with UV Effluent – Field and Lab Water Quality Data in the Blueleaf Report in Appendix C provides a summary of Bromate sampling results.

The adsorptive capacity of the GAC contactors downstream of the advanced oxidation system will remove any oxidation byproducts produced from the advanced oxidation treatment process.

The GAC contactors will not create oxidation byproducts. The carbon media adsorbs the perfluorinated compounds and other organic constituents. These contaminants remain on the carbon media until they are removed through incineration or high temperature re-activation of the media.

Section 10

TATA & HOWARD

SECTION 10 – FINAL RECOMMENDATION

10.1 General

The primary criteria used to evaluate the effectiveness of GreensandPlus, LayneOx™, Advanced Oxidation, and Granular Activated Carbon were iron and manganese removal, 1,4 dioxane removal, PFOS/PFOA removal, ease of operation, and cost effectiveness. Recommendations for future course of action are presented in this section.

10.2 Conclusions

As discussed in Section 7, the results obtained from the pilot study showed that both GreensandPlus and LayneOx™ medias were capable of reducing iron to less than 0.05 mg/L and manganese levels to less than 0.01 mg/L (both below the respective SMCLs) through oxidation with sodium hypochlorite. Raw water 1,4 dioxane was effectively destroyed to below laboratory detection limits in all samples over the eight-week extended advanced oxidation pilot run conducted with the Trojan UV reactor. Raw water PFOS and PFOA were effectively removed by adsorption with the GAC contactors. The average combined raw PFOS and PFOA concentration of 95.5 ng/L observed during the pilot test was reduced to below laboratory detection limits in all samples collected during the pilot test.

Below is a summary of additional conclusions reached following completion of pilot testing:

Iron and Manganese Removal

- Filters were operated at filter surface loading rates between 4 gpm/sf and 6.4 gpm/sf. It is unknown if filter runtime would be limited by headloss or breakthrough. Filters were operated up to 70 hours at loading rates of 4 and 6 gpm/sf and only shut down for scheduled changes.
- For both GreensandPlus and LayneOx™ medias, filter run times are capable of exceeding the minimum 24-hour criteria, with differential pressures below 10 psi.
- Pressure filtration with both medias appeared to meet all other drinking water standards including secondary contaminants, and disinfection byproducts.
- In the absence of pressure filtration, iron was oxidized by hydrogen peroxide and removed by the GAC contactors during the pilot test. Hydrogen peroxide from the advanced oxidation process acted as a strong oxidizer thereby, allowing the iron to easily convert from a soluble to insoluble state leading to removal of iron by the GAC contactors. Iron does not adsorb to the carbon media, which allows it to accumulate on the surface of the media enabling it to be removed by backwashing.
- More frequent backwashing of the GAC media will be required if greensand filtration is not implemented, which may minimally reduce the lifespan of the carbon media.

- Based on the results of the pilot testing, iron will continue to be oxidized by hydrogen peroxide with the continued use of an iron and manganese sequestering agent.
- In the absence of pressure filtration for iron and manganese removal, manganese passed through the GAC contactors in the soluble state. This was observed based on similar effluent manganese results during pilot testing from the advanced oxidation processes (Table No. 3.25 in the Blueleaf Report) as compared to the effluent manganese results from the GAC contactors (Table No. 3.27 in the Blueleaf Report). The hydrogen peroxide dosage required for the advanced oxidation process along with the required contact time is not sufficient to completely oxidize manganese and allow for removal of manganese by the GAC contactors.
- GAC media quenches residual hydrogen peroxide, which should prevent further oxidation of manganese within the water distribution system beyond what occurs within the GAC contactors.
- Based on observations during pilot testing, the use of hydrogen peroxide as a strong oxidizer with advanced oxidation treatment should not create turbid water as a result of sequestered manganese.

<u>1,4 Dioxane Removal</u>

- The smaller generic UV system was not capable of proper advanced oxidation and destruction of 1,4 dioxane due to insufficient UV outlet and lack of proper reaction with hydrogen peroxide.
- The UV Transmittance (UVT) of UV pilot influent (raw water) is 99.7%. This is significantly higher than the estimated UVT of 95% used during the Conceptual Design phase of the project, which assumed lower water quality than the actual water quality documented during the pilot test. The higher UVT requires lower power demand from the UV reactors and thus significantly lower capital cost for the UV reactors.
- Effective advanced oxidation was achieved with two different peroxide (H_2O_2) dose/ballast power level (BPL) combinations; (1) 5 ppm H_2O_2 and 100% BPL and (2) 1 ppm H_2O_2 and 60% BPL. Both scenarios were operated at 20 gpm.
- The GAC filters will quench any residual hydrogen peroxide from the advanced oxidation process. The quenched residual hydrogen peroxide will not adsorb to the carbon media. The media will convert the residual hydrogen peroxide to water through the catalytic function and pass through the carbon filter bed and, therefore, it will not add to the carbon usage rate. The hydrogen peroxide dosage can also be optimized to minimize the residual carryover of hydrogen peroxide from the advanced oxidation process.
- There was no visual evidence of UV lamp sleeve fouling based on weekly inspections, even without iron and manganese removal. Fouling was controlled by frequent operation (once every two hours) of the UV reactor wiper mechanism. In addition, the very high UVT readings help offset the fouling impact.
- One of the UV lamp sleeves was shipped to Trojan UV for UVT analysis. Trojan UV determined that the fouling factor of the pilot sleeve was 0.94. This was similar to the fouling factor of 0.95 validated by a third party for Trojan UV.

Fouling factor is defined as the ratio of the UVT of an aged and fouled UV sleeve to the UVT of a new and clean sleeve. It should be noted that the fouling factor was based on analysis of one of the 12 sleeves used during the pilot test. The observed fouling factor from the pilot test was reviewed by Trojan UV research and manufacturing personnel against new sleeves and expected fouling and met with their satisfaction.

PFOS/PFOA Removal

- The successful removal of PFOS/PFOA was achieved with 36 inches of GAC (Calgon Filtrasorb 400) media allowing 11 minutes of empty bed contact time.
- When the GAC contactors were exposed to 1,4 dioxane in the influent the GAC removed approximately half of the influent concentration. A properly functioning UV advanced oxidation treatment system upstream of the GAC contactors produced water capable of stripping accumulated 1,4 dioxane from the contactors.

10.3 Treatment Design and Building Recommendations

The results of the pilot testing suggest that implementation of iron and manganese removal treatment processes may not be required at this time. Average raw water total iron concentrations observed during pilot testing for the three Maher Wells ranged from 0.07 mg/L to 0.24 mg/L, below the SMCL (non-enforceable) for iron. Average raw water total manganese concentrations observed during pilot testing for the three Maher Wells ranged from 0.069 to 0.109 mg/L. Although all concentrations exceeded the non-enforceable SMCL of 0.05 mg/L, the concentrations were still well below the Massachusetts Office of Research and Standards Guideline (MA ORSGL) of 0.3 mg/L for manganese. Despite the MA ORSGL of 0.3 mg/L, the MassDEP has recently required public water suppliers with total manganese levels in water supplies of 0.21 mg/L (70% of the MA ORSGL) to develop a plan to keep manganese levels in water supply sources reliably and consistently between 0.21 mg/L and 0.3 mg/L. The ORSGL was developed to address potential health concerns of manganese in drinking water. The average raw water total manganese levels observed at the Maher Wells during the pilot testing were less than half of the MassDEP's current enforcing limit. We are of the opinion that iron and manganese concentrations during full-scale treatment will be comparable to concentrations observed during the pilot test.

Although there was evidence of iron removal in the GAC media based on water quality data and some visual accumulation at the surface of the media, the differential pressure never approached 10 psi, which is when a backwash would normally be initiated. The GAC contactors were never backwashed during the pilot test. However, one can conclude that based on the water quality data and some visual accumulation of iron in the pilot test media, lack of iron and manganese removal will likely require backwashing of the carbon filters more often than if iron and manganese removal processes were implemented in the full-scale filtration plant.

Although pilot testing results suggest that the need for iron and manganese removal may not be immediate, implementation of Option No. 2, which includes greensand filtration, advanced oxidation, and GAC filtration, is recommended.

The following summarizes reasons for this recommendation:

- The removal of iron and manganese would improve water quality within the water distribution system and, subsequently, reduce the amount of dirty water calls from water customers and reduce the amount of system flushing.
- Removal of iron and manganese ahead of advanced oxidation and GAC filtration would benefit the functionality, efficiency, and life span of the equipment and media.
- There is the potential for the ORSGL for manganese to be reduced in the future pending further research by State and Federal agencies.
- Intervals between backwashing of the GAC contactors would increase resulting in an increase in the life span of the carbon media.
- Although backwashing of the GAC contactors was not required during pilot testing, it is anticipated that the introduction of iron to the carbon media for an extended period of time at the full-scale facility would require periodic backwashing of the carbon media, which would not normally be needed if iron were not present in the water.
- It is anticipated that the filtration plant will operate with minimal interruptions during the summer months. This may minimize the ability of the carbon filter bed to expand during shutdowns to compensate for the added iron removal and lead to an increase in differential pressure requiring more frequent backwashing of the carbon media if greensand filtration is not implemented.
- Fouling of the UV lamp sleeves associated with advanced oxidation would be reduced, thereby improving the efficiency of the equipment and lengthening the lamp replacement interval.
- Sequestering of iron and manganese would no longer be required resulting in reduced chemical costs.
- Construction of all proposed treatment processes under one construction contract (Option No. 2) in lieu of Option No. 1 and implementing greensand in the future would simplify design and optimize construction of the filtration plant and result in a substantially lower total project cost.

Based the results of the advanced oxidation pilot testing, which demonstrated high UVT and low hydroxyl radical scavenging, we recommend that the Town proceed with advanced oxidation with hydrogen peroxide for the removal of 1,4 dioxane from the source waters at the Maher Wells. The recommended UV reactor system includes two trains of TrojanUVPhox^{TM} 30AL50 (one duty reactor per 750 gpm train) and one identical redundant train (per the Town's request). The operating dose of hydrogen peroxide shall be 4.5 mg/L. Table No. 10-1 shows a summary of the design conditions for the advanced oxidation removal system necessary to provide 1,4 dioxane levels below detection limits.

Table No. 10-1
Advanced Oxidation System Design Criteria

Criteria	UV Reactor Design
Flow capacity per train	750 gpm
UV Transmittance	98%
Log Inactivation	0.5 (0.8 to <0.3 µg/L)
Hydrogen Peroxide Dose	4.5 mg/L

Based the results of the advanced oxidation pilot testing, which reduced PFOS and PFOA levels to below laboratory detection limits in all samples collected during the pilot test, we recommend that the Town proceed with GAC filtration for the removal of PFOS and PFOA from the source waters at the Maher Wells. Table No. 10-2 shows a summary of the design conditions for the GAC filtration system necessary to provide PFOS and PFOA levels below detection limits.

Table No. 10-2
GAC Filtration System Design Criteria

Criteria	Carbon Contactor
Empty Bed Contact Time (minutes)	10
Filter Size	(6) 10' Diameter
Filter Media Quantity (lbs.)	20,000
Filter Run Time (hrs)	*
Backwash Rate (gpm/sf)	8.3
Backwash Duration (minutes)	20
Backwash Flow Rate (gpm)	650
Backwash Volume (per filter)	1,300

* Dependent upon water quality. Extended run time if Fe and Mn removal is utilized.

Proposed design criteria for implementation of iron and manganese removal treatment processes is provided in Table No. 10-3. The table shows a summary of the recommended design conditions for the pressure filtration system necessary to provide iron and manganese levels below SMCLs for both GreensandPlus and LayneOx™ media.

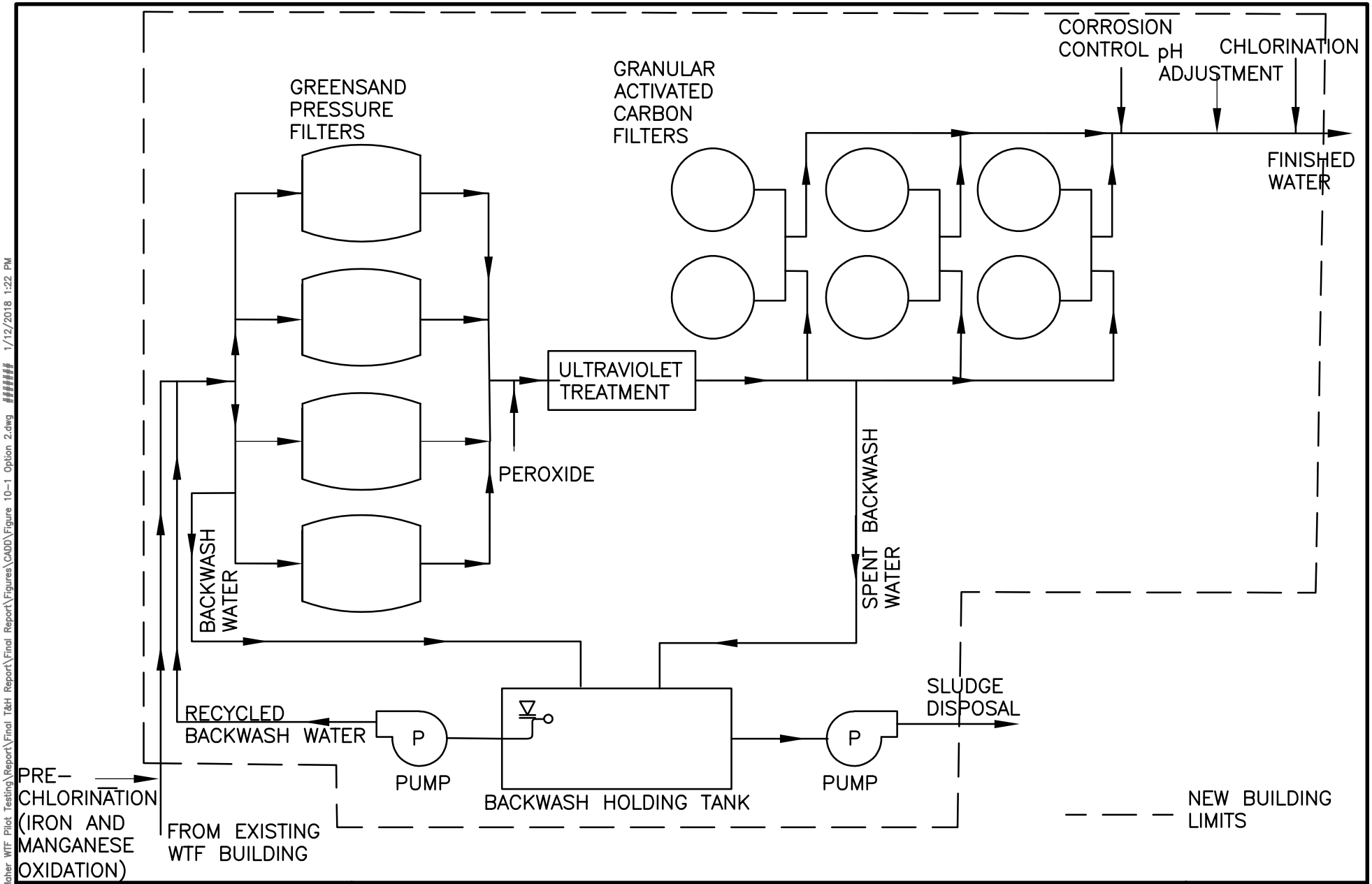
Table No. 10-3
Pressure Filtration Media Design Criteria

Criteria	GreensandPlus	LayneOx™
Filter Loading Rate (gpm/ sq. ft.)	4.8	5.9
Filter Size	(4) 10' Dia.	(4) 9' Dia.
Filter Media Depth (in.)	36 + 12" carbon	48
Filter Run Time (hrs)	>70	>70
Backwash Rate (gpm/sf)	10-12	25
Backwash Duration (minutes)	10	5
Backwash Flow Rate (gpm)	785-940	1590
Backwash Volume (gal/day)	31,400-37,600**	31,800**
Chlorine Dosage Required	1.6 ppm	1.6 ppm
Chlorine Usage per MG Treated	11 gal	11 gal
Sodium Hydroxide Required	3.5 ppm	3.5 ppm
Sodium Hydroxide per MG Treated	4.5 gal.	4.5 gal.

* Backwash volume does not include filter-to-waste volume, which is approximately 375 gpm for 3 minutes per filter, for a total of 4,500 gal.
** Assumes all filters backwashed once per day.

Figure No. 10-1 shows the proposed treatment schematic for recommended Option No. 2, including greensand filtration for iron and manganese removal, advanced oxidation for 1,4 dioxane removal and GAC filtration for PFOS/PFOA removal at the Maher Filtration Plant. Figure No. 10-2 shows a preliminary filtration plant floor plan for recommended Option No. 2. The full-scale design of the proposed facility can commence upon pilot test approval.

A proposed project schedule is provided in Appendix G.



TATA & HOWARD

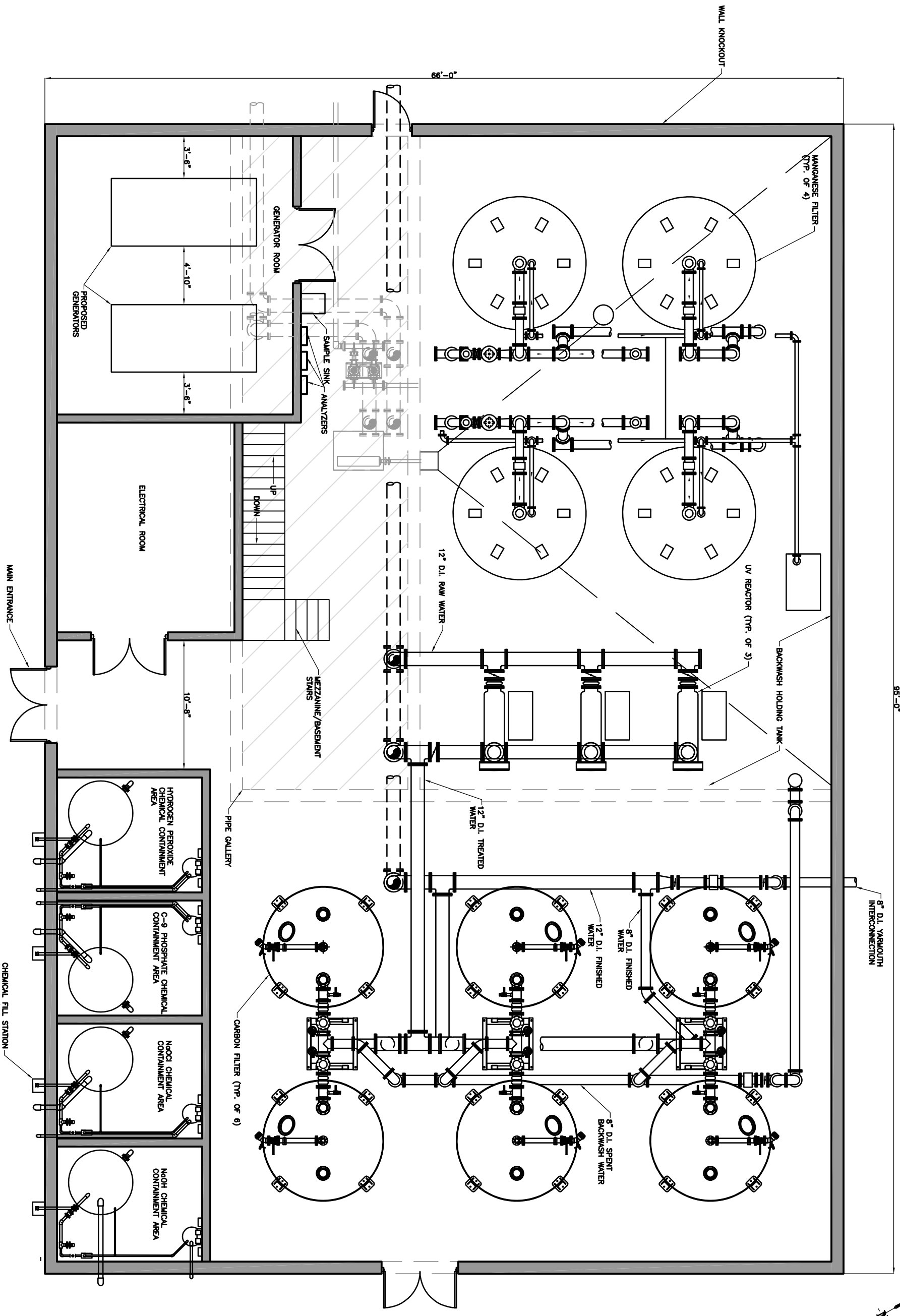
DATE: JANUARY 2018 SCALE: NONE

PROPOSED TREATMENT SYSTEM SCHEMATIC
OPTION No. 2 - GREENSAND FILTRATION, ADVANCED OXIDATION, AND CARBON FILTRATION
MAHER FILTRATION PLANT - PILOT TEST REPORT

TOWN OF BARNSTABLE DPW - WATER DIVISION

Figure No.

10-1



TATA & HOWARD

DATE: JANUARY 2018 SCALE: NONE

PRELIMINARY WATER FILTRATION PLANT FIRST FLOOR PLAN
OPTION NO. 2 - GREENSAND FILTRATION, ADVANCED OXIDATION, AND CARBON FILTRATION

MAHER FILTRATION PLANT - PILOT TEST REPORT
TOWN OF BARNSTABLE DPW - WATER DIVISION

Figure No.

10-2

Appendix A

TATA & HOWARD

BRP WS 21D
PILOT TEST PROPOSAL
JUNE 2017

Maher Filtration Plant
Barnstable, Massachusetts

TATA & HOWARD

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June 2, 2017

Mr. Richard Rondeau
Drinking Water Program
Massachusetts Department of Environmental Protection
Southeast Regional Office
20 Riverside Drive
Lakeville, MA 02347

Subject: Pilot Test Proposal – Maher Filtration Plant
BRP WS 21D – Approval to Conduct a Pilot Study = or > 1 mgd
MassDEP Transmittal No. X275188
Barnstable, Massachusetts
T&H No. 5128

Dear Mr. Rondeau:

On behalf of the Town of Barnstable DPW - Water Supply Division, Tata & Howard, Inc. is pleased to submit two copies of the enclosed BRP WS 21D – Approval to Conduct a Pilot Study = or > 1 mgd for the removal of iron and manganese, 1,4-dioxane, Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA) from the Maher Well Nos. 1, 2, and 3.

The Town of Barnstable proposes to evaluate two treatment processes, GreensandPlus and LayneOx, for removal of iron manganese, advanced oxidation for removal of 1,4-dioxane, and granular activated carbon (GAC) for removal of PFOS and PFOA. Pilot testing will be conducted by Blueleaf, Inc. as a sub-consultant to Tata & Howard upon MassDEP approval of the enclosed pilot test proposal. A Pilot Test Report will be submitted to MassDEP following completion of the pilot test, and will include an analysis of the treatment data, evaluation of the effectiveness of the proposed treatment processes, and an estimated size and design flow for the proposed treatment plant including cost estimates for construction, operation, and maintenance.

We are available to discuss any questions you may have regarding this proposal at your convenience. Please call should you have any questions or require additional information in this regard.

Tata & Howard
67 Forest Street | Marlborough, MA 01752
T: 508-303-9400 | F: 508-449-9400
www.tataandhoward.com

Other Offices
MA | NH | CT | ME | VT | AZ | TX

25 YEARS 1992-2017

Sincerely,

TATA & HOWARD, INC.

Jon W. Gregory, P.E.
Project Manager

Enclosures

cc: Mr. Hans Keijser, Supervisor
Barnstable DPW - Water Supply Division

Mr. Michael Gorenstein, P.E., Project Manager
Barnstable DPW - Water Supply Division

Enter your transmittal number → X275188 (Transmittal Number)

Your unique Transmittal Number can be accessed online: http://mass.gov/dep/service/online/trasmfrm.shtml

Massachusetts Department of Environmental Protection

Transmittal Form for Permit Application and Payment

1. Please type or print. A separate Transmittal Form must be completed for each permit application.

2. Make your check payable to the Commonwealth of Massachusetts and mail it with a copy of this form to: DEP, P.O. Box 4062, Boston, MA 02211.

3. Three copies of this form will be needed.

Copy 1 - the original must accompany your permit application. **Copy 2** must accompany your fee payment. **Copy 3** should be retained for your records

4. Both fee-paying and exempt applicants must mail a copy of this transmittal form to:

MassDEP
P.O. Box 4062
Boston, MA
02211

*** Note:**
For BWSC Permits, enter the LSP.

A. Permit Information

BRP WS 21D	Approval to Conduct Pilot Study = or > 1 mgd
1. Permit Code: 4 to 7 character code from permit instructions	2. Name of Permit Category

Pilot Test for Existing Groundwater Supply
3. Type of Project or Activity

B. Applicant Information – Firm or Individual

Town of Barnstable Department of Public Works - Water Supply Division
1. Name of Firm - Or, if party needing this approval is an individual enter name below:

2. **Last Name** of Individual	3. **First Name** of Individual	4. MI

47 Old Yarmouth Road
5. Street Address

6. City/Town	7. State	8. Zip Code	9. Telephone #	10. Ext. #
Hyannis	MA	02601	508-775-0063	

11. Contact Person	12. e-mail address
Hans Keijser	Hans.Keijser@town.barnstable.ma.us

C. Facility, Site or Individual Requiring Approval

Maher Water Treatment Plant
1. Name of Facility, Site Or Individual

47 Old Yarmouth Road
2. Street Address

3. City/Town	4. State	5. Zip Code	6. Telephone #	7. Ext. #
Hyannis	MA	02601	508-775-0063	

8. DEP Facility Number (if Known)	9. Federal I.D. Number (if Known)	10. BWSC Tracking # (if Known)

D. Application Prepared by (if different from Section B)*

Tata & Howard, Inc.
1. Name of Firm Or Individual

10 Riverside Drive, Suite 204
2. Address

3. City/Town	4. State	5. Zip Code	6. Telephone #	7. Ext. #
Lakeville	MA	02347	508-386-9339	

8. Contact Person	9. LSP Number (BWSC Permits only)
Jon W. Gregory, P.E.	

E. Permit - Project Coordination

1. Is this project subject to MEPA review? ☐ yes ☒ no
   If yes, enter the project's EOEA file number - assigned when an Environmental Notification Form is submitted to the MEPA unit:

EOEA File Number

F. Amount Due

DEP Use Only

Permit No:

Rec'd Date:

Reviewer:

Special Provisions:

1. ☒ **Fee** Exempt (city, town or municipal housing authority)(state agency if fee is $100 or less).
   There are no fee exemptions for BWSC permits, regardless of applicant status.
2. ☐ Hardship Request - payment extensions according to 310 CMR 4.04(3)(c).
3. ☐ Alternative Schedule Project (according to 310 CMR 4.05 and 4.10).
4. ☐ Homeowner (according to 310 CMR 4.02).

Check Number	Dollar Amount	Date

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Drinking Water Program

BRP WS Application

For Drinking Water Program (Water Supply) Permits or Approvals

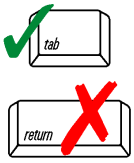
X275188
Transmittal Number

Facility ID# (if known)

A. Application

1. Is this application for ☒ an Original or ☐ a Resubmittal?

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



2. Applicant:

Name			Address	
Town of Barnstable			47 Old Yarmouth Road	
City	**State**	**Zip**	**Contact**	**Telephone**
Hyannis	MA	02601	Hans Keijser	508-775-0063

3. Consultant:

Name			Address	
Tata & Howard, Inc.			10 Riverside Drive, Suite 204	
City	**State**	**Zip**	**Contact**	**Telephone**
Lakeville	MA	02347	Jon W. Gregory, P.E.	508-386-9339

B. Permit

Please check the permit or approval for which you are applying:

Zone II Determination for Existing Sources
- ☐ BRP WS 07 Approval to Conduct Pump Test for Zone II Delineation
- ☐ BRP WS 08 Approval of Zone II Delineation

New Technology
- ☐ BRP WS 11 Minor New Technology Approval; where no field test required
  - ☐ Drinking Water Additive
  - ☐ Cross Connection Device
  - ☐ Water Vending Machine
  - ☐ Other (specify):
- ☐ BRP WS 12 Major New Technology Approval: where field testing is required
- ☐ BRP WS 27 New Technology with Third-party Approval
- ☐ BRP WS 28 Vending Site/Source Prototype
- ☐ BRP WS 31 Vending and POU/POE Devices with Third-party Approval

New Source Approvals <70 gpm
- ☐ BRP WS 13 Exploratory Phase, Site Examination, Land Use Survey and Approval to Conduct Pumping Test
- ☐ BRP WS 15 Pumping Test Report Approval and Approval to Construct Source
- ☐ BRP WS 37 Approval of Transient Non-Community Source Less than 7 Gallons per Minute (combines BRP WS 13 and BRP WS 15 submittals)

New Source Approvals = or > 70 gpm
- ☐ BRP WS 17 Exploratory Phase, Site Examination, Land Use Survey, and Conduct Pumping Test
- ☐ BRP WS 19 Pumping Test Report Approval
- ☐ BRP WS 20 To Construct Source

Water Treatment Approvals
- ☐ BRP WS 21A To Conduct Pilot Study < 40,000 gpd
- ☐ BRP WS 21B To Conduct Pilot Study = or > 40,000 gpd and < 200,000 gpd
- ☐ BRP WS 21C To Conduct Pilot Study = or > 200,000 gpd and < 1 mgd
- ☒ BRP WS 21D To Conduct Pilot Study = or > 1 mgd
- ☐ BRP WS 22A Pilot Study Report < 40,000 gpd
- ☐ BRP WS 22B Pilot Study Report = or > 40,000 gpd and < 200,000 gpd
- ☐ BRP WS 22C Pilot Study Report = or > 200,000 gpd and < 1 mgd
- ☐ BRP WS 22D Pilot Study Report = or > 1 mgd
- ☐ BRP WS 23A To Construct Facility <40,000 gpd
- ☐ BRP WS 23B To Construct Facility = or > 40,000 gpd and < 200,000 gpd
- ☐ BRP WS 23C To Construct Facility = or > 200,000 gpd and < 1 mgd
- ☐ BRP WS 24 To Construct Facility = or > 1 mgd
- ☐ BRP WS 25 Treatment Facility Modification
- ☐ BRP WS 29 Water Treatment: Chemical Addition Retrofits of Water Systems > 3,300 people
- ☐ BRP WS 30A Vending Installation Approval
- ☐ BRP WS 30B POU/POE Installation Approval
- ☐ BRP WS 34 Water Treatment: Chemical Addition Retrofits of Water Systems = or < 3,300 people
- ☐ BRP WS 35A Multiple Vending Installation Approval
- ☐ BRP WS 35B Multiple POU/POE Installation Approval

Water Quality Assurance
- ☐ BRP WS 26 Sale or Acquisition of Land for Water Source
- ☐ BRP WS 36 Abandonment of Water Source

Distribution System Modifications
- ☐ BRP WS 32 Systems > 3,300 people
- ☐ BRP WS 33 Systems = or < 3,300 people

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Drinking Water Program

BRP WS Application

For Drinking Water Program (Water Supply) Permits or Approvals

X275188
Transmittal Number

Facility ID# (if known)

C. Certification

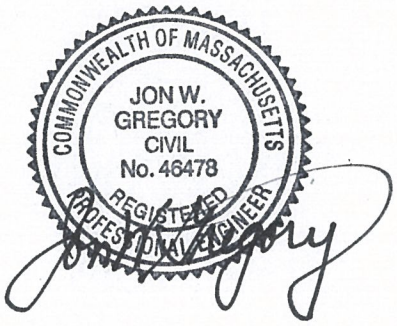
"I certify, under penalty of law, that this application and all attachments were prepared under my supervision, in accordance with a system designed to ensure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information submitted in this application, the information submitted is, to the best of my knowledge and belief, true, accurate and complete."

Jon W. Gregory
Authorized Signature

June 2, 2017
Date

Jon W. Gregory, P.E.
Print Name

Project Manager
Position/Title



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BRP WS 21D Application

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SECTION 1 – INTRODUCTION

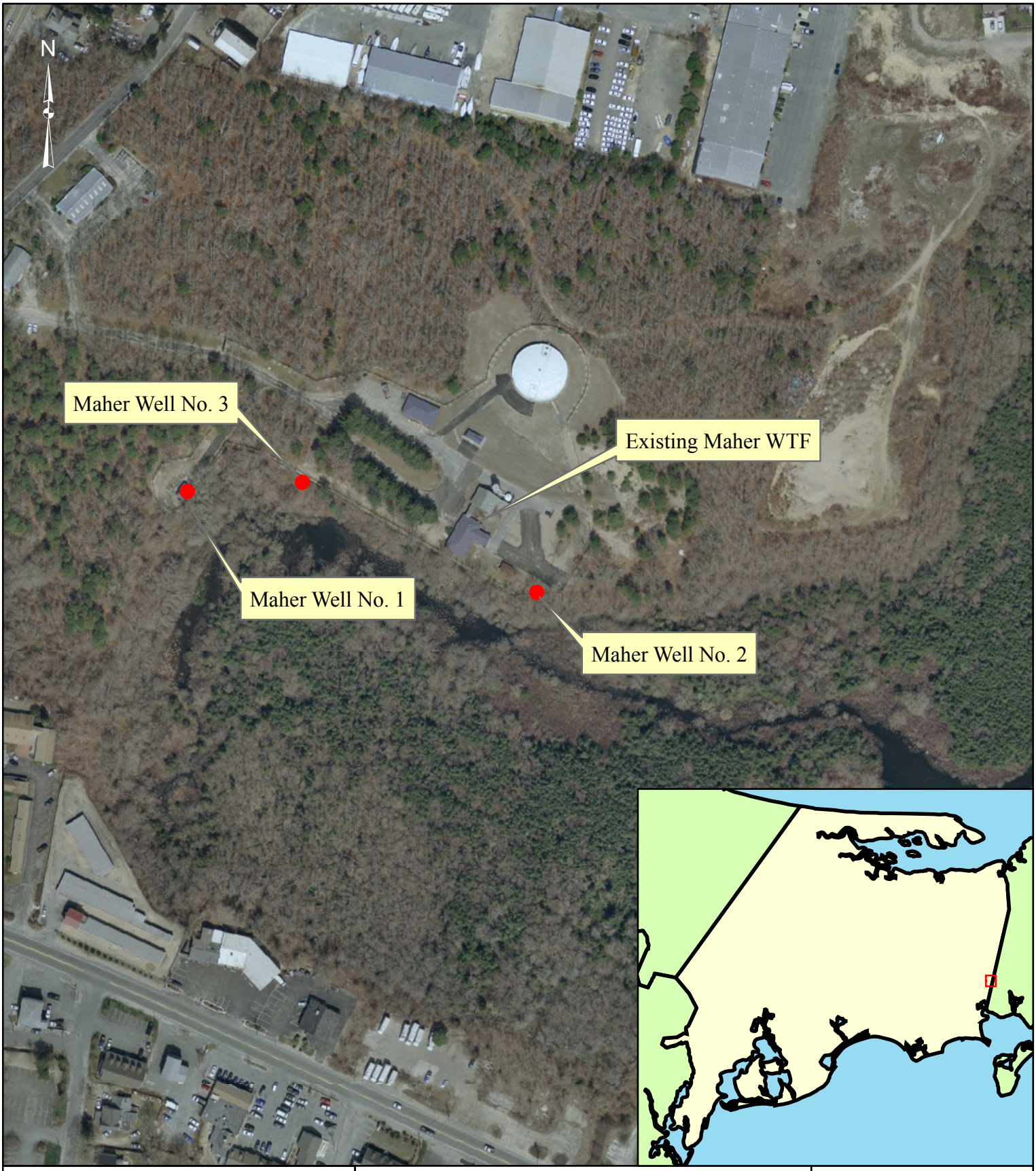
1.1 Background

The Town of Barnstable's Maher Water Treatment Plant (WTP) treats three gravel packed water supply wells, Maher Well No. 1, Maher Well No. 2, and Maher Well No. 3. Each well is permitted through the Water Management Act Permit Program to produce an average of 1.008 million gallons per day (mgd), which is equivalent to a pumping rate of 700 gallons per minute (gpm) over a 24-hour period. Each well pump can currently produce approximately 500 to 550 gpm. The maximum capacity through the existing WTP is approximately 2.16 mgd (1,500 gpm).

Each well source is pumped to the Maher WTP and treated with a blended phosphate to sequester iron and manganese in solution. The water from each source is combined and treated through an air stripper to remove volatile organic compounds (VOCs) and discharges into a below grade clearwell. When used, water from the interconnection with the Town of Yarmouth is combined with water from the Maher wells in the clearwell. Water is pumped from the clearwell and treated with chemical addition for disinfection (sodium hypochlorite), pH adjustment (sodium hydroxide), and corrosion control (zinc orthophosphate). Finished water is stored in the onsite 800,000 gallon Maher Water Storage Tank. This tank provides contact time for compliance with 4-log disinfection requirements if needed in the future under the Groundwater Rule for the Maher wells. The yard piping configuration at the WTP provides operators with the flexibility to use the finished water pumps to feed the Maher Water Storage Tank or the distribution system directly. A site map of the Maher Wells and WTP is shown in Figure No. 2-1.

Currently, raw water from the three Maher wells contains levels of perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS), and 1,4-dioxane that require treatment/removal to provide optimum water quality to customers. The Town has made efforts to reduce the levels of PFOS/PFOA and 1,4 dioxane at the Maher WTP. Well No. 1, which currently has the highest PFOS/PFOA level of the three wells, was taken off-line and the water system interconnection with the Town of Yarmouth was activated to blend Yarmouth supplied water with water from the Maher wells.

The Town has opted to pursue construction of upgrades at the existing facility to treat PFOS/PFOA and 1,4-dioxane and intends to conduct a pilot test to determine the required design parameters and best technology to achieve the desired treated water. Piloting for iron and manganese and PFOS/PFOA removal is also included to determine if removal of the low levels of iron and manganese in the raw water will be required for proper operation of equipment for PFOS/PFOA and 1,4 dioxane treatment. The MassDEP has confirmed that pilot testing of GAC filtration at the Maher facility is not a statutory requirement due to the current use of this water treatment technology at the Mary Dunn Wells and the availability of current water quality data for treatment of PFOS/PFOA within the same water system. However, the Town has decided to include GAC filtration with pilot testing of advanced oxidation and iron and manganese removal to evaluate the performance of all



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Date: June 2017
Approximate Scale: 1" = 200'

Site Map

Maher Water Treatment Facility Upgrades
Pilot Test Proposal
Barnstable, MA

Figure No.

1-1

proposed treatment processes operating together and conduct and evaluate pilot runs that do not include iron and manganese removal.

1.2 Purpose

The Massachusetts Department of Environmental Protection (MassDEP) guidelines require all water treatment projects to be preceded by the completion of a pilot test proposal, pilot testing, and a pilot test report. The Town intends to develop a treatment method to produce water that consistently meets current and future State and Federal drinking water standards, specifically to reduce the levels of PFOS/PFOA, 1,4-dioxane, and iron and manganese (if required) to below set levels established by the MassDEP and or the United States Environmental Protection Agency (USEPA), and to provide flexibility with the new treatment systems for treatment of emerging contaminants in the future. The pilot testing will assist in determining the specific operational and performance characteristics of the treatment process throughout the anticipated range of raw water quality, hydraulic loading, chemical feed rates, and operational conditions.

This pilot test proposal contains the anticipated timeframe for pilot testing, the water quality parameters to be analyzed and specific analyses to be completed, and a discussion of the proposed methods of water treatment to be piloted.

SECTION 2 – WATER QUALITY

2.1 General

Primary drinking water regulations are established by the USEPA to protect public health and to set enforceable maximum contaminant levels (MCLs). The USEPA has also established secondary maximum contaminant levels (SMCLs) for water quality criteria that generally affect the aesthetic qualities of drinking water, such as taste, color, odor, and appearance. USEPA lifetime Health Advisory (HA) levels establish maximum concentrations of contaminants in drinking water for which cancer and noncancer health effects are not anticipated to occur over exposure durations of one day, ten days, and a lifetime for children and adults. The HAs are not enforceable but serve as guidance for Federal, State, local officials, and water systems. Applicable regulations and sampling results for contaminants of concern present in the water from the three existing Maher water supply sources are reviewed in this section.

2.2 Drinking Water Standards and Water Quality Data

Perfluorinated Chemicals

PFOS and PFOA are fluorinated organic chemicals that are part of a larger group of chemicals referred to as perfluoroalkyl substances. The USEPA included PFOA and PFOS in the list of contaminants that water systems are required to monitor under its third Unregulated Contaminant Monitoring Rule (UCMR 3) in 2012.

The USEPA has not set drinking water standards for PFOS and PFOA, but in May 2016, the USEPA reduced its previously issued lifetime HA for each chemical to 0.07 micrograms per liter (µg/l). When both chemicals are present in drinking water, the USEPA recommends the levels be added together and not exceed the 0.07 µg/l for a combination of the two chemicals. The MassDEP is using the USEPA lifetime HA level of 0.07 µg/l to require treatment or blending of source water to levels below the HA even though a specific Federal or State regulation level has not been set.

PFOS and PFOA sampling results from May 2016 for the three Maher wells are shown in Table No. 2-1. The PFOS concentrations exceeded the lifetime HA level at the Maher Well No. 1 and Maher Well No. 3. Maher Well No. 1 exhibited the highest levels of PFOS/PFOA with a combined concentration of 0.132 µg/l, nearly twice the lifetime HA level. The combined PFOS/PFOA concentration at Maher Well No. 3 measured 0.084 µg/l, just above the lifetime HA level. The combined PFOS/PFOA concentration at Maher Well No. 2 measured 0.0373 µg/l and was below the lifetime HA level. Since the elevated PFOS/PFOA levels were discovered, the Town has utilized its interconnection with the Town of Yarmouth to blend the waters to keep PFOS and PFOA levels below the new lifetime HA while maintaining a production rate sufficient to meet summer demands. A graph of historical PFOS/PFOA levels in the Maher Wells is shown in Figure No. 2-1.

Figure No. 2-1
Historical PFOS/PFOA Levels
Maher Water Filtration Plant Pilot Test Proposal
Barnstable, MA

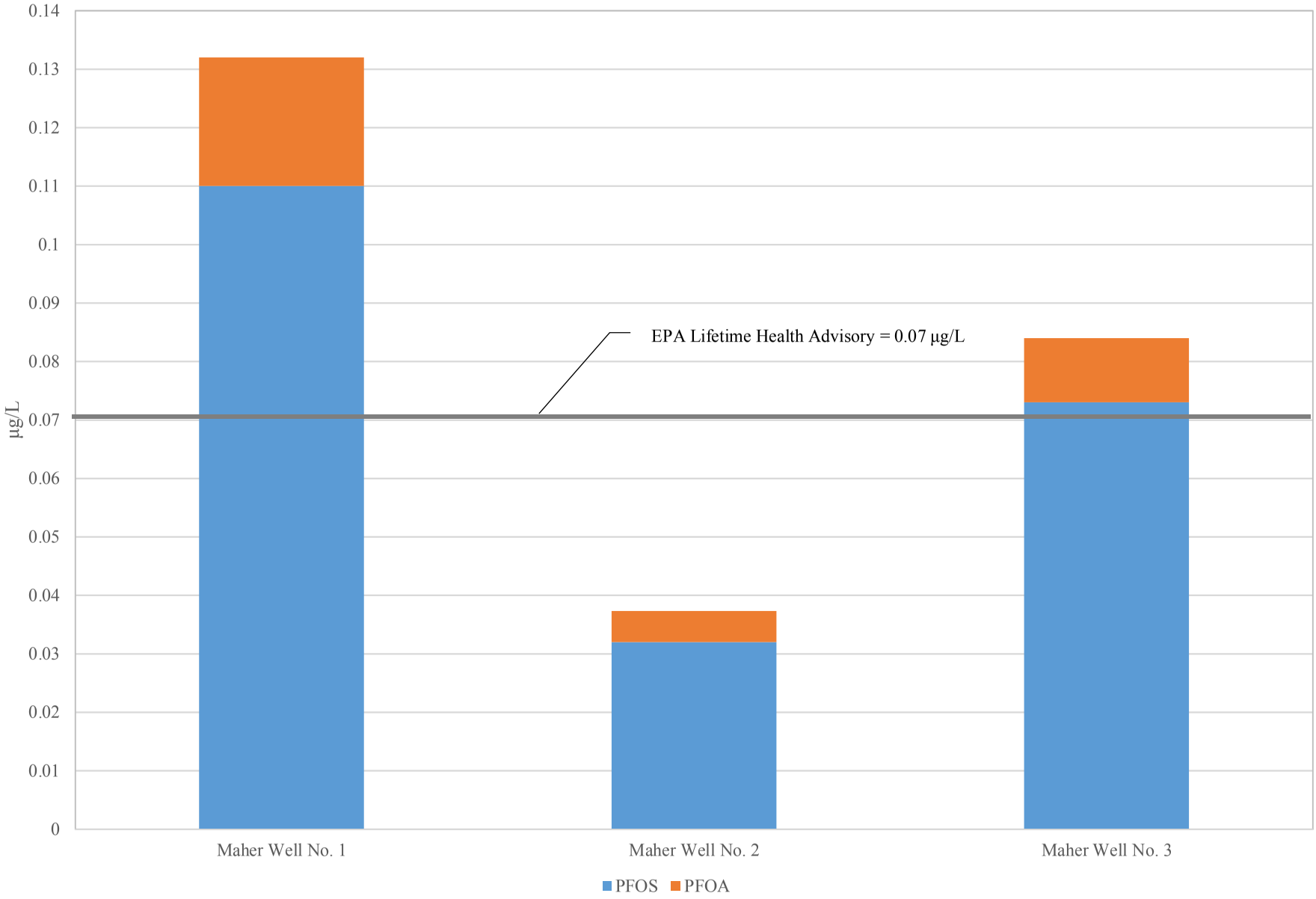

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Table No. 2-1
PFOS and PFOA Levels at Maher Wells No. 1, No. 2, and No. 3

Well No.	May 2016			Lifetime HA Level (µg/l)
	PFOS (µg/l)	PFOA (µg/l)	Total PFC (µg/l)	
Maher No. 1	0.11	0.022	0.132	0.07
Maher No. 2	0.032	0.0053	0.0373	0.07
Maher No. 3	0.073	0.011	0.084	0.07

1,4-Dioxane

1,4-dioxane is a volatile organic compound (VOC) that is produced commercially and used for a variety of manufacturing processes. This compound can leach into and remain in groundwater due to its high solubility in water, limited sorption to soils, and resistance to biodegradation. Unlike other VOCs, which are typically removed through air stripping and carbon filter adsorption to a lesser extent, 1,4-dioxane is resistant to removal by air stripping and carbon filtration technologies.

The USEPA has not set drinking water standards for 1,4-dioxane but has established HA levels and cancer risk assessment levels based on drinking water-specific risk level concentrations for cancer and based on concentrations in drinking water at which adverse health effects may occur. In addition to USEPA's HA and cancer risk assessment levels, the Massachusetts Office of Research and Standards set a Guideline Limit (ORSGL) of 0.3 µg/l for 1,4-dioxane in drinking water. Although a federal drinking water standard has not yet been developed, the MA ORSGL is being used by the MassDEP to regulate 1,4-dioxane levels in drinking water sources, and the MassDEP can require treatment for removal or blending of source water to reduce 1,4-dioxane levels below the MA ORSGL.

Samples from each of the three Maher wells were collected and tested for 1,4-dioxane in May 2015 and May 2016. The 1,4-dioxane sampling results are shown in Table No. 2-2. The concentrations for 1,4-dioxane in both samples collected from Maher Well No. 1 were 0.26 µg/l, just below the MA ORSGL. Both 1,4-dioxane samples collected from Maher Well No. 2 exceeded the MA ORSGL at 0.44 µg/l in May 2015 and 0.82 µg/l in May 2016. The sample for 1,4-dioxane collected in May 2015 at the Maher Well No. 3 was above the MA ORSGL at 0.36 µg/l, while the sample collected in May 2016 at the Maher Well No. 3 was below the MA ORSGL at 0.24 µg/l. A graph of historical 1,4-dioxane levels in the Maher Wells is shown in Figure No. 2-2.

Figure No. 2-2
Historic 1,4-Dioxane Levels
Maher Water Filtration Plant Pilot Test Proposal
Barnstable, MA

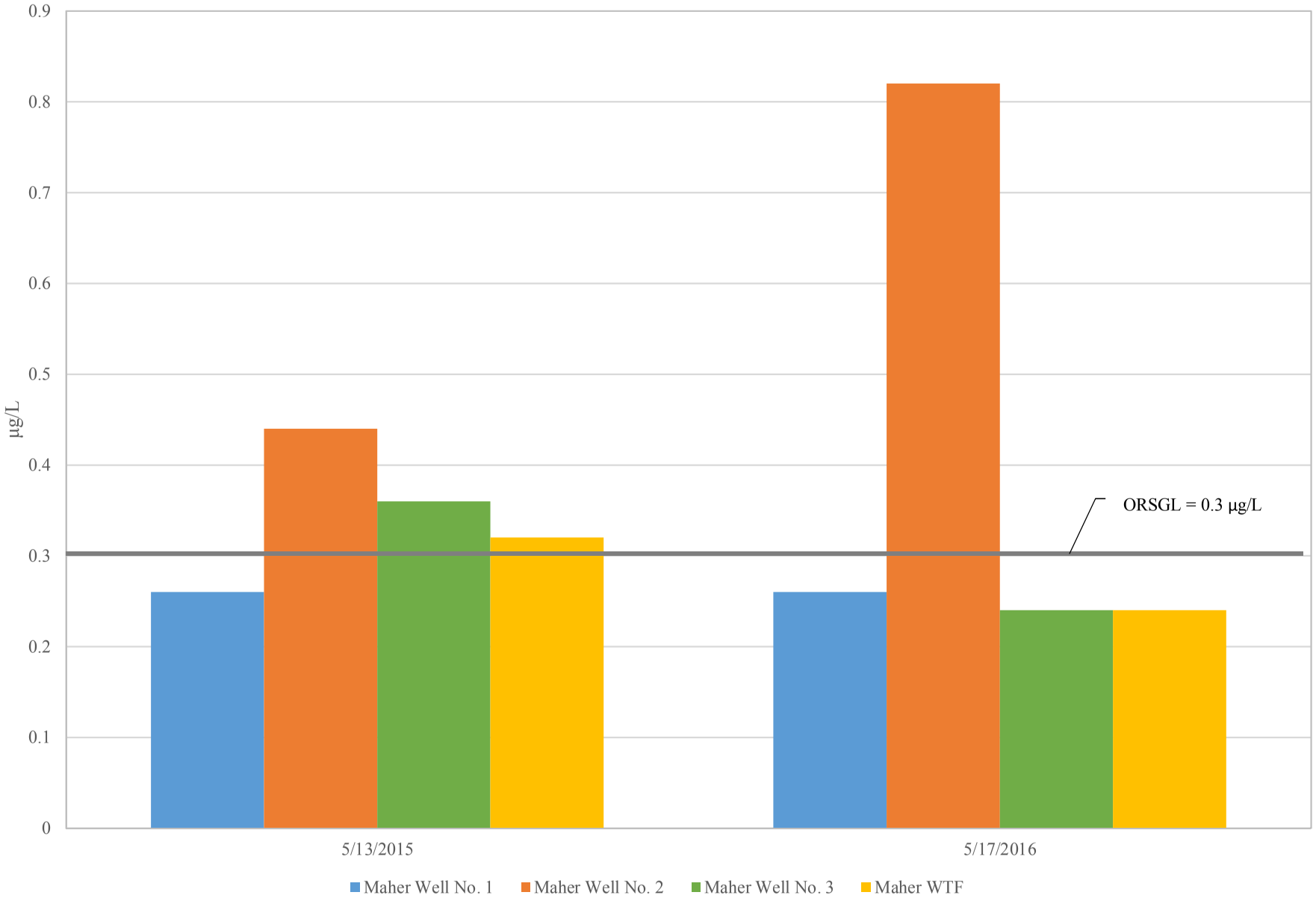

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Table No. 2-2
1,4 Dioxane Levels at Maher Wells in 2015 and 2016

Well No.	1,4-Dioxane (µg/l)		
	MA ORSGL	5/13/2015	5/17/2016
Maher No. 1	0.3	0.26	0.26
Maher No. 2	0.3	0.44	0.82
Maher No. 3	0.3	0.36	0.24

Iron and Manganese

The USEPA has set and the MassDEP has adopted SMCLs for iron and manganese concentrations in drinking water of 0.3 milligrams per liter mg/l and 0.05 mg/l, respectively. SMCLs are not federally or state enforceable regulations, but iron and manganese levels in drinking water at or above the SMCL can result in taste, odor, and color complaints by water customers.

The USEPA and the Massachusetts Office of Research and Standards have also implemented HA levels and ORSGLs for manganese. The Massachusetts ORSGL for lifetime exposure by adults and for acute exposure (ten days) by infants less than one year of age is 0.3 mg/l.

Secondary contaminant sampling results in April 2014, July 2015, and August 2016 for iron and manganese from the 100-foot finish water sample tap on the distribution pump discharge from the Maher WTP are shown in Table No. 2-3. The concentration of iron measured in the samples in April 2014 and August 2016 was below the detectable limit (ND). In July 2015, the iron level was measured at 0.161 mg/l, which was below the SMCL.

Table No. 2-3
Iron and Manganese Levels at the Maher WTP 100-Foot Sample Tap

Secondary Contaminant	April 2014	July 2015	August 2016	SMCL	MA ORSGL[1]
Iron (mg/l)	ND	0.161	ND	0.3	N/A
Manganese (mg/l)	0.066	0.037	0.026	0.05	0.3

[1] MA ORSGL set for lifetime exposure by adults and acute exposure by infants less than one year of age.

The three manganese samples measured at 0.066 mg/l, 0.037 mg/l, and 0.026 mg/l, respectfully, indicate that typical combined manganese levels are close to the aesthetic based SMCL of 0.05 mg/l with the April 2014 sample exceeding the SMCL. All samples were below the MA ORSGL for manganese. Although iron and manganese levels can increase over time at a well source, historical manganese levels have been relatively consistent at the Maher wells and remain below the MA ORSGL. Graphs of historical iron and manganese levels in the Maher Wells are shown in Figure No. 2-3 and Figure No. 2-4.

Figure No. 2-3
Historic Iron Levels
Maher Water Filtration Plant Pilot Test Proposal
Barnstable, MA

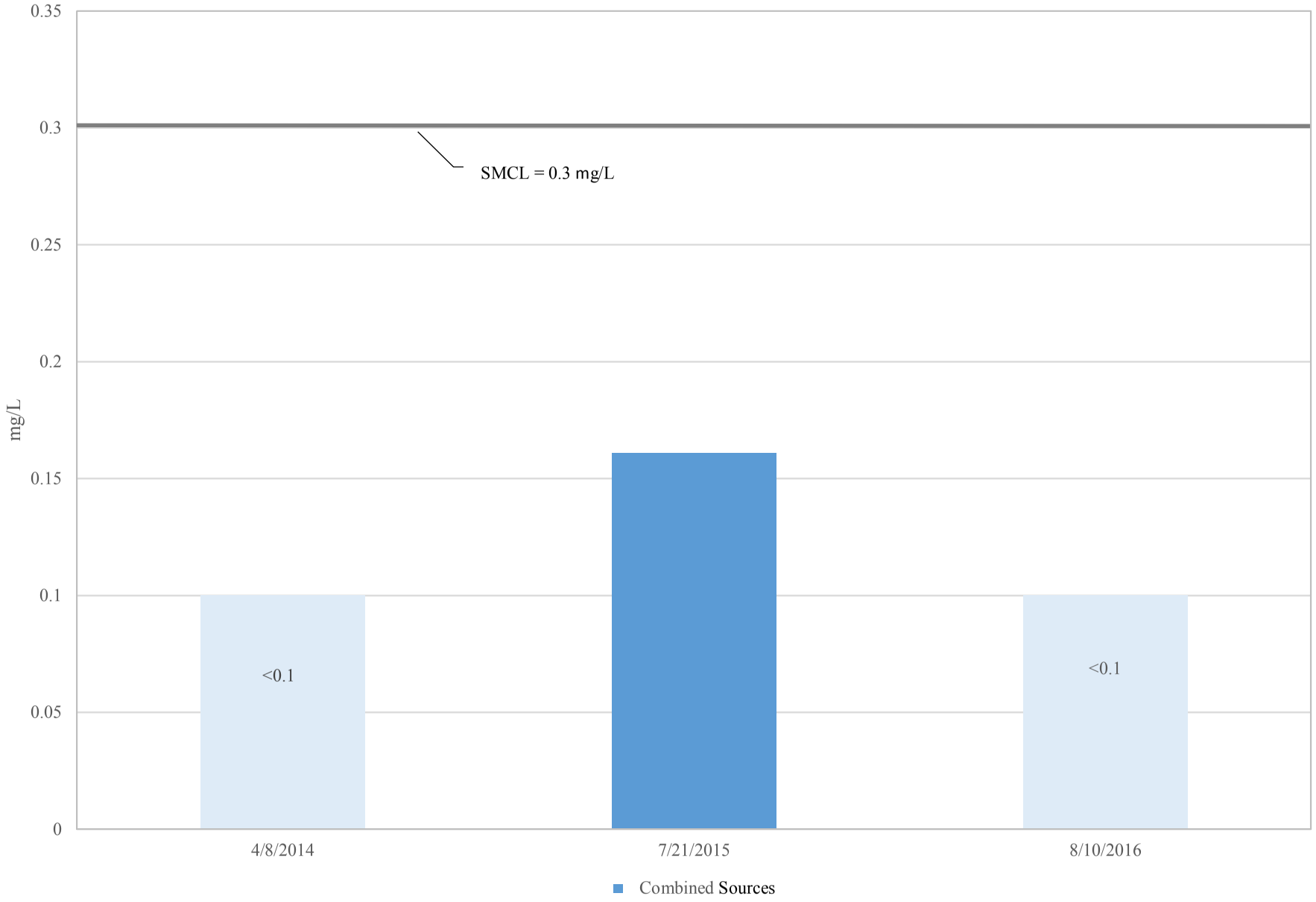

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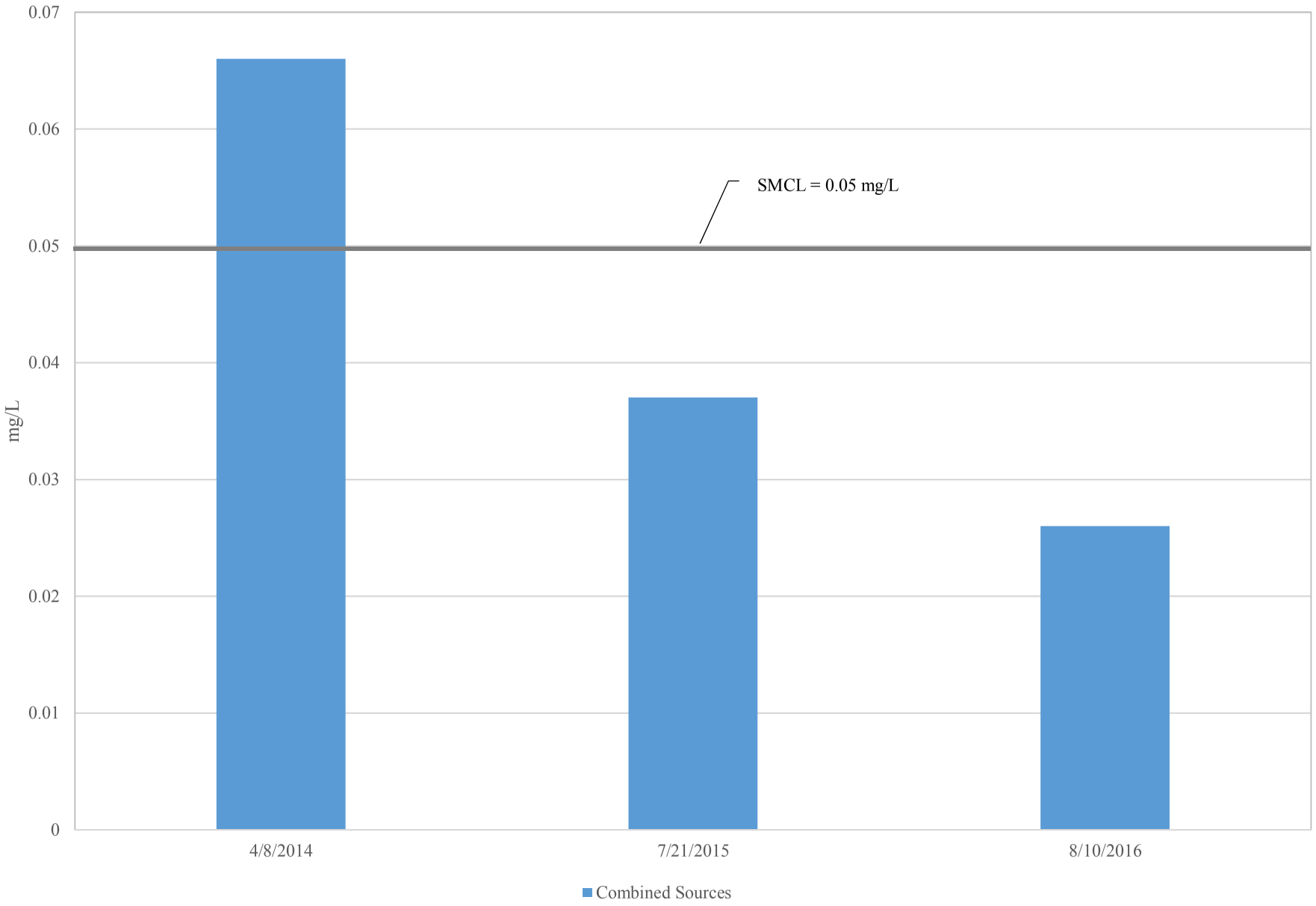
Figure No. 2-4
Historical Manganese Levels
Maher Water Filtration Plant Pilot Test Proposal
Barnstable, MA



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Water Quality Summary

The water quality at the Maher facility was reviewed in this section to identify the contaminants of concern at the three existing Maher sources and evaluate the levels of each contaminant in relation to the regulatory levels being enforced by the MassDEP. Table No. 2-4 summarizes the highest levels of PFOS/PFOA, 1,4-dioxane, iron, and manganese measured in the water at the Maher facility based on the available sampling reviewed and the regulatory levels at which the MassDEP requires compliance. PFOS/PFOA levels have been combined in Table No. 2-4 to show the total level at each source since the regulatory HA level is based on the combined PFOS/PFOA level.

Table No. 2-4
Summary of Existing Maher Source Water Quality and Regulatory Compliance Levels

Contaminant	Maher No. 1	Maher No. 2	Maher No. 3	Compliance Regulation	Regulation Level
PFOS/PFOA	0.132	0.0373	0.084	USEPA HA	0.07 µg/l
1,4-Dioxane	0.26	0.82	0.36	MA ORSGL	0.3 µg/l
Iron	0.161[1]			N/A	N/A
				SMCL (non-enforceable)	0.3 mg/l
Manganese	0.066[1]			MA ORSGL	0.3 mg/l
				SMCL (non-enforceable)	0.05 mg/l

[1]Iron and manganese levels were measured in combined finished water samples.

2.3 Water Quality Goals

Several pilot test runs that use different combinations of treatment technologies will be conducted to determine the effectiveness of each process for the treatment plant. These technologies will be reviewed in further detail in Section 3 of this report and a summary of the proposed pilot test runs is detailed in Section 4. The pilot study will also be used to determine the specific operational and performance characteristics of the selected treatment process throughout the anticipated range of raw water quality, hydraulic loading rates, chemical feed rates, and operational conditions. It is the goal of this study to determine if the technologies will be cost effective, straightforward to operate and maintain, will not produce excessive quantities of residuals, and meet the USEPA and MassDEP existing and projected regulations for PFOS/PFOA, 1,4-dioxane, iron, and manganese.

Although most existing finish water concentrations of iron and manganese are below the Massachusetts SMCLs, piloting for iron and manganese is proposed to determine if removal of the low levels of iron and manganese will be required for proper operation of equipment for PFOS/PFOA and 1,4-dioxane treatment.

SECTION 3 – TREATMENT ALTERNATIVES

3.1 Process Evaluation

GreensandPlus, LayneOx™, Advanced Oxidation, and Granular Activated Carbon (GAC) Filtration were selected as the proposed treatment technologies. Pilot tests are proposed for three technologies in series and for using only GAC Filtration and Advanced Oxidation. Greensand and LayneOx™ filtration are used for iron and manganese removal and would replace the iron and manganese sequestering practices utilized at the existing WTP. Advanced oxidation utilizes ultraviolet (UV) treatment and hydrogen peroxide for 1,4-dioxane reduction. GAC filters act as a polishing filter process to maintain a stable, consistent finished water quality, increase organics removal, and remove PFOS/PFOA and other emerging contaminants.

3.2 GreensandPlus

GreensandPlus, the trade name for Inversand's oxide-coated sand product, is a manufactured filter media used for the removal of iron, manganese, hydrogen sulfide, arsenic, and radium from water supplies. The substrate media has a manganese dioxide coated surface that acts as a catalyst in the oxidation-reduction reaction of manganese. The difference between GreensandPlus and conventional manganese greensand is in the substrate that forms the core of the media and the method by which the manganese dioxide coating is attached to that substrate. GreensandPlus has a silica sand core and the coating is fused to it. Manganese Greensand has a glauconite core and the coating is ionically bound to the core. This difference enables GreensandPlus to absorb soluble manganese and use chlorine for regeneration, while Manganese Greensand requires the use of potassium permanganate. GreensandPlus has an operational pH range of 6.2 to 8.5 and is more durable than conventional greensand.

The GreensandPlus process utilizes a layer of anthracite which acts as a physical filter for the manganese precipitated by the addition of the chlorine oxidant. Below the anthracite top layer is an oxide-coated sand media, which acts as a catalyst in the oxidation of the manganese. Manganese that is oxidized in this part of the process is then removed via adsorption or physical filtration. Disinfection treatment is performed by a contact tank using a disinfectant, in this instance chlorine. An additional benefit with the use of GreensandPlus media for removal of iron and manganese is that it will also reduce the amount of sedimentation and chlorine demand at the facility and will no longer require sequestering of iron and manganese during the water treatment process.

3.3 LayneOx™

LayneOx™ is a proprietary catalytic media marketed by Layne-Christensen Company. It is a naturally occurring mined manganese dioxide pyrolusite media that has been used in treatment plants throughout the United States. The media has a very high manganese dioxide content, averaging 60 percent, which eliminates the need for the addition of potassium permanganate. LayneOx™ is not pH sensitive within recommended pH ranges

for drinking water. Its relatively high hardness may provide a longer service life than the softer greensand media, and unlike greensand, air scouring in the initial phases of backwashing is not necessary.

LayneOx™ solely utilizes adsorption for the removal of manganese, which translates to filter loading rates ranging from 4 to 12 gallons per minute per square foot (gpm/sf) depending on the raw water quality and desired backwash frequency (i.e. once per 24 hours of operation).

3.4 Advanced Oxidation

Advanced oxidation uses ultraviolet (UV) light with hydrogen peroxide to remove 1,4-dioxane. UV oxidation is a photochemical process that breaks down chemical constituents into their physiologically-inert component parts. This process includes the addition of hydrogen peroxide to the influent water followed by a photochemical reaction that occurs almost instantly within the UV reactor. The irradiation of hydrogen peroxide by UV light breaks the hydrogen peroxide into two hydroxyl radicals. These highly reactive radicals oxidize 1,4-dioxane, breaking it down into its non-toxic molecular components. In addition, the UV oxidation system is capable of breaking down and reducing the concentrations of pharmaceuticals, personal care products, and volatile organic compounds that may be present in the source water.

Following iron and manganese sequestering (or following the greensand pressure filters at the new Maher Filtration Plant if iron and manganese removal is implemented), water will enter the UV oxidation area where hydrogen peroxide is injected into the water just prior to it entering the UV reactor. After the 1,4-dioxane treatment, the water will exit the UV reactor and enter the GAC filters for PFOS/PFOA removal and quenching of any residual hydrogen peroxide prior to final chemical addition.

During the pilot study, the full impact of iron and manganese removal prior to the advanced oxidation and carbon filtration processes will be evaluated. The pilot study will also determine how the sequestering chemical and the presence of iron and manganese affect the efficiency of the advanced oxidation process for 1,4-dioxane removal.

3.5 Granulated Activated Carbon Filtration

Granulated activated carbon (GAC) filtration has proven to be effective in removal of PFOS/PFOA from drinking water. GAC filtration is commonly used to adsorb PFOS/PFOA in water systems. Adsorption is a physical and chemical process of accumulating a substance at the interface between the liquid and solid media phases. Following iron and manganese sequestering or pressure filtration and advanced oxidation treatment, water will enter the carbon filters. The GAC filters will quench any residual hydrogen peroxide from the advanced oxidation process.

3.6 Historical Application of Selected Alternatives

Greensand pressure filtration has been used successfully in many applications around New England and in Massachusetts to treat for iron and manganese removal to levels below the SMCLs and even below detectable limits. Tata & Howard has conducted successful pilot studies of greensand filtration in Ayer, Fairhaven, Natick, Falmouth, Littleton, Templeton, North Attleborough, Mansfield, and Shrewsbury, Massachusetts. In these studies, the greensand filtration pilot test reduced the levels of iron and manganese noted at the beginning of the filter runs, to below detectable concentrations. The pilot studies have resulted in the design and construction of greensand treatment facilities in Mansfield (1.5 mgd), Natick (4.0 mgd) North Attleborough (2.0 and 4.4 mgd facilities), and Ayer (1.5 mgd), which have all been producing high quality water for several years. Other facilities designed by Tata & Howard include the 4.4 mgd facility in Falmouth and a 0.5 mgd facility in Templeton. The treatment process has shown the added benefit of removing trace amounts of arsenic from the water.

Tata & Howard successfully completed several pilot studies using LayneOx™, specifically in Canton, Concord, Hopedale, Northborough, and Shrewsbury, Massachusetts. The pilot studies using this technology resulted in the removal of iron and manganese levels noted in the beginning of the filter runs, to below detectable concentrations. The pilot studies have resulted in the design and construction of LayneOx™ treatment facilities in Canton (0.95 mgd), Concord (2.0 mgd) and Hopedale (0.60 mgd).

Advanced oxidation for the treatment of 1,4 dioxane is a new potable water treatment technology in the Commonwealth of Massachusetts. This process has successfully treated 1,4 dioxane in drinking water supplies in other parts of the United States, including Tucson, Arizona and the Suffolk County Water Authority in Long Island, New York. The Town intends to request site specific new technology approval from MassDEP for the advanced oxidation treatment process following the completion of the pilot test and approval of the pilot test report by MassDEP.

GAC filtration is currently used by the Town of Barnstable at the Mary Dunn Wells for effective removal of PFOS/PFOA from the source water.

SECTION 4 – PILOT TESTING

4.1 General

The Town of Barnstable proposes to utilize the services of Blueleaf, Inc. for pilot testing of GreensandPlus and LayneOx™ to remove iron and manganese, advanced oxidation to treat 1,4 dioxane, and GAC filtration for the removal of PFOS/PFOA from source waters at the Maher Wells. Two different UV reactor skids with hydrogen peroxide will be piloted for the advanced oxidation treatment process; a small-scale UV system for low flows during runs utilizing iron and manganese removal and a large-scale UV reactor supplied by Trojan UV for use during pilot runs without iron and manganese removal. Pilot test runs will also be conducted utilizing only advanced oxidation and GAC filtration.

Up to ten (10) pilot runs will be performed including, but not limited to the following.

- Initial set up run;
- Run using test loading rates;
- Run using increased or decreased loading rates depending on initial results;
- Run with GreensandPlus, small-scale UV unit, and GAC;
- Run with LayneOx™, small-scale UV unit, and GAC;
- Run with Trojan UV reactor and GAC only;
- Extended run (up to 8 weeks) without iron and manganese removal, using the small-scale UV unit, and an extended run using the Trojan UV reactor skid without iron and manganese removal.

The purpose of the pilot test is to determine the effectiveness of the chosen treatment technologies at removing 1,4-dioxane and PFOS/PFOA and the effect of iron and manganese removal on the other treatment processes. The pilot test will demonstrate the ability of the selected processes to meet water quality goals set forth by the USEPA. A pilot test report will be submitted following completion of the pilot test and will present a detailed evaluation of the water quality results from the pilot test. The Town proposes to utilize the raw water from all three Maher Wells during the pilot test.

The existing facility treats raw water from the Maher Wells through an air stripper. After the water is treated through the air stripper, chemicals are added for pH adjustment, disinfection, and corrosion control. The iron and manganese treatment would occur after the air stripper but before the chemical addition. GreensandPlus media is not pH dependent within the ranges predicted to occur; however, the pH will be sampled. The pilot test results will not be affected by using raw water with a different pH than the raw water treated for iron and manganese.

4.2 Time Period/Duration

The Town of Barnstable proposes to conduct the pilot study upon approval from MassDEP. A variety of pilot runs using the GreensandPlus and LayneOx™ media, UV reactor skids with hydrogen peroxide, and GAC filtration will be conducted during the course of the study to optimize loading rates, chemical dosages, filter run times, finished water quality,

and backwash water characterization. The parameters that will be monitored are flow rate, filter head loss and/or breakthrough, temperature, and chemical feed rates. Backwash water from the GreensandPlus and LayneOx™ filters will be analyzed to estimate settling characteristics, suspended solids, and volume in order to determine size of recycle/detention tanks. Pilot runs using the three technologies in series will be conducted over a three-week period. Upon completion of this primary pilot testing, extended testing will be conducted using only GAC and advanced oxidation for eight weeks.

4.3 GreensandPlus Pilot Description

The oxide-coated sand pilot unit is presented schematically in Figure No. 4-1. The oxide-coated sand process uses a layer of anthracite which acts as a physical filter for iron and manganese precipitated by the addition of the chlorine oxidant. The next layer is oxide-coated sand media, which acts as a catalyst in the oxidation of the iron and manganese. The iron and manganese that is oxidized in this part of the process is then removed via adsorption or physical filtration.

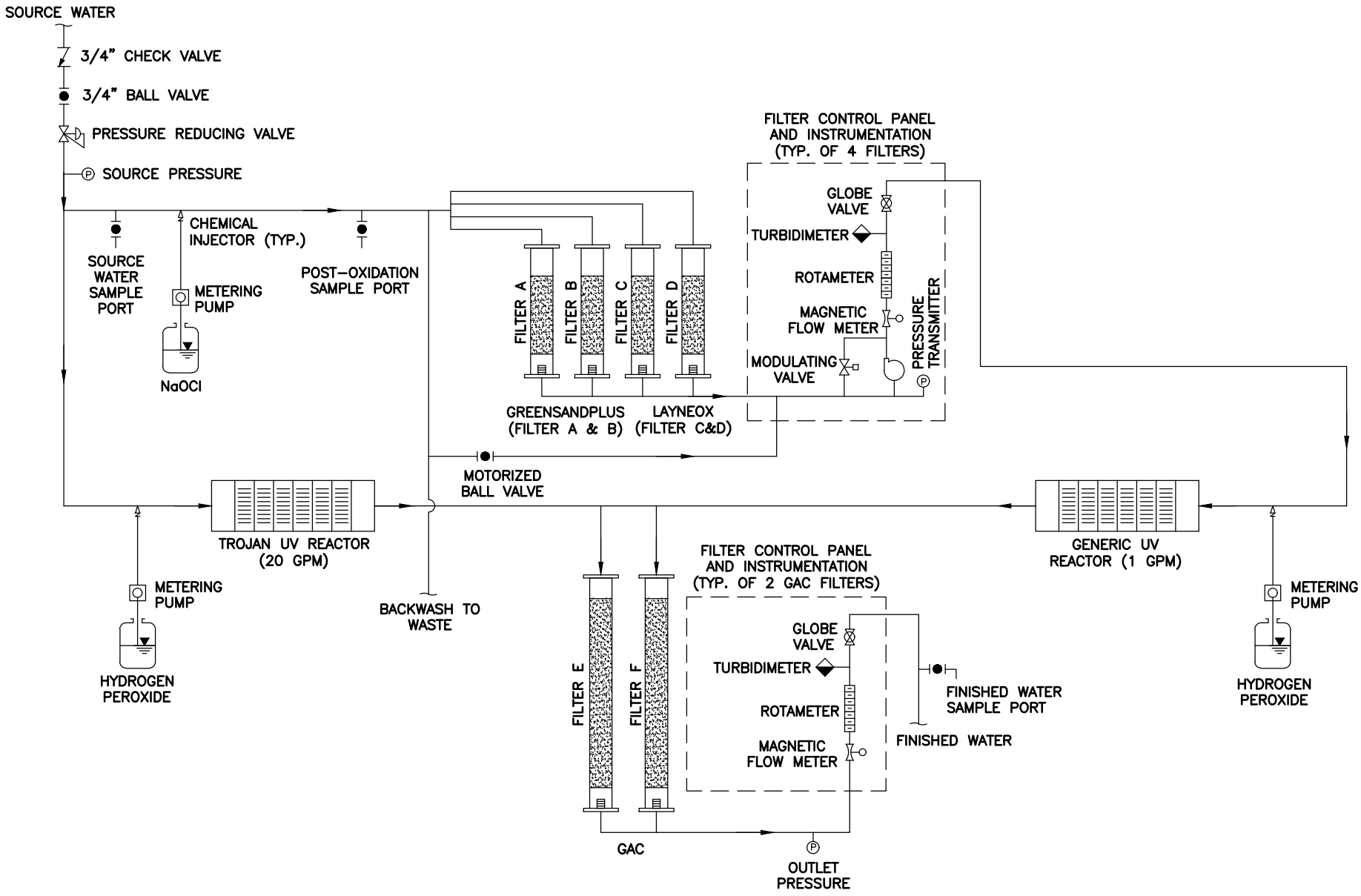
4.4 LayneOx™ Pilot Description

The manganese dioxide granular filter media pilot unit is presented schematically in Figure No. 4-1. Chlorine injection in the raw water stream before the filter is used to oxidize the iron and manganese. Oxidized iron and manganese are removed by the physical filter properties of the media while iron and manganese that are not fully oxidized become catalytically precipitated and then adsorbed directly on the media.

4.5 Advanced Oxidation Pilot Description

The UV reactors (generic small-scale with a flow rate of 1 gpm and Trojan UV with a flow rate of 20 gpm) are presented schematically in Figure No. 4-1. As previously noted, the small-scale UV reactor will be used to meet the low flow requirements associated with the iron and manganese removal processes and the Trojan UV reactor will be used during pilot runs without iron and manganese removal where higher flows are permissible.

Hydrogen peroxide is injected into source water prior to reaching the UV reactor. The irradiation of hydrogen peroxide by the UV light breaks down the hydrogen peroxide into two hydroxyl radicals. These highly reactive radicals oxidize 1,4-dioxane, breaking it down into its non-toxic molecular components. The water exits the UV reactor and enters



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PILOT TESTING PROCESS SCHEMATIC

MAHER FILTRATION PLANT
PILOT TEST PROPOSAL
BARNSTABLE, MASSACHUSETTS

Figure No.

4-1

the GAC filters for PFOS/PFOA removal and quenching of any residual hydrogen peroxide from the advanced oxidation process.

4.6 GAC Pilot Description

The GAC filter media pilot unit is presented schematically in Figure No. 4-1. Treated water from advanced oxidation treatment enters the filter units, which contain coal-based granular activated carbon media. The media adsorbs PFOS/PFOA from the water supply and quenches residual hydrogen peroxide following the advanced oxidation treatment process.

4.7 Raw Water Pretreatment

In the first step of the treatment process, the raw water will be pretreated for oxidation, disinfection, and pH control (if required) using sodium hypochlorite and sodium hydroxide, respectively. Liquid sodium hypochlorite solution will be fed to the untreated raw water to oxidize the soluble iron and manganese.

The proposed chlorine concentration to be used during the pilot test will be calculated based on the average iron and manganese concentration in the raw water. However, actual chlorine dose will be closely monitored and adjusted in the field to reflect actual chlorine demand and to produce a measurable residual similar to the concentration currently leaving the facility. The estimated detention time will vary for each process. The GreensandPlus detention time is estimated to be less than one minute. The LayneOx™ system detention time is estimated to be approximately thirty (30) seconds.

4.8 Oxidation

Liquid sodium hypochlorite solution will be fed to the raw untreated water to oxidize the soluble iron and manganese. The proposed chlorine concentration to be used during the pilot test will be calculated based on the average iron and manganese concentration in the raw water measured at the onset of the pilot test. The chlorine concentration is estimated to be approximately 0.2 mg/L to 1.0 mg/L, assuming chlorine is the only oxidant. However, actual chlorine dose will be closely monitored and adjusted in the field to reflect actual chlorine demand and to produce a measurable residual similar to the concentration currently leaving the facility. The estimated detention time will vary for each process. The GreensandPlus detention time is estimated to be less than one minute. The LayneOx™ system detention time is estimated to be approximately thirty (30) seconds.

4.9 GreensandPlus, Advanced Oxidation, and GAC Filtration Pilot Process

The pilot scale GreensandPlus filtration process equipment will be provided for iron and manganese removal. Chlorine (sodium hypochlorite) will be used as the primary oxidant. A sufficient dose of chlorine will be fed to the raw water to perform iron and manganese oxidation, and to produce a residual in the treated water similar to the concentration currently leaving the facility. Chlorine will provide continuous regeneration of the media.

The raw water pH from the Maher Wells will be measured at the onset of piloting to determine if the water is within the recommended range of 6.2 to 8.5 for GreensandPlus filtration, therefore, eliminating the need for pH adjustment during pilot testing.

The pilot process for GreensandPlus filtration, shown schematically in Figure No. 4-1, consists of chemical oxidation, low head filtration and disinfection. The oxide-coated sand process uses a layer of anthracite which acts as a physical filter for manganese precipitated by the addition of the chlorine oxidant. The next layer is oxide-coated sand media, which acts as a catalyst in the oxidation of the iron and manganese. The iron and manganese that is oxidized in this part of the process is then removed via adsorption or physical filtration.

The two filters will provide approximately 0.2 square feet of surface area each. The initial flow rate will be set at 0.8 gallons per minute (gpm) producing an average loading rate of 4.0 gpm per square foot. The optimization period is anticipated to last five days, and the process equipment will operate for an additional 10 days to provide water to the downstream advanced oxidation process. The run on each filter shall end when either terminal headloss is achieved (10 psi), breakthrough occurs, or the filter run exceeds 24 hours.

Additional runs at other loading rates will be completed as well. The pilot test will be operated under continuous regeneration mode. The GreensandPlus filter media will be regenerated with chlorine during the operation of the filter. The GreensandPlus pilot system design criteria are shown in Table No. 4-1.

Table No. 4-1
GreensandPlus Filtration Process Parameters

Name		Parameter
Number of Filters:		2
Filter Diameter:		6”
Filter Area:		0.2 ft^2
Base Flow rate:		0.8 gpm
Base Loading Rate:		4.0 gpm/ ft^2
Media	Anthracite	12” depth
	GreensandPlus	24” depth
Theoretical Chlorine Dosage:		mg/l Cl_2 = (1 x mg/L Fe) + (2 x mg/l Mn)
Duration:		15 days
Mode:		Continuous Regeneration

Chemical metering pumps with adjustable feed rate control will be used to feed the treatment chemicals in liquid form, into the raw water supply line to the filters. Chemical dosages will initially be based upon the stoichiometric levels required to achieve complete oxidation of manganese. The theoretical dosages are based on the average total concentrations of manganese using the equations presented above. The theoretical dosage of chlorine will be calculated based on the maximum manganese concentrations in the raw water. Dosages will be trimmed based upon field-testing and the actual oxidant demand

exhibited by the raw water, and to yield an effluent chlorine residual of 1.0 parts per million (ppm).

Piloting for the advanced oxidation system will include a hydrogen peroxide feed and UV reactor and is presented schematically in Figure No. 4-1. The small-scale UV reactor will be piloted with iron and manganese removal to meet the low required flows associated with iron and manganese removal. A metered hydrogen peroxide feed will provided with the UV light to complete the advanced oxidation process. The hydrogen peroxide feed will be closely monitored at the onset to determine the optimal feed rate required to oxidize 1,4-dioxane by breaking it down into its non-toxic molecular components while minimizing the amount of residual hydrogen peroxide that must be quenched in the GAC filters.

The proposed GAC loading rate is approximately 6.4 gpm/sf. The empty bed contact time (EBCT) of the pilot test will be approximately 11 minutes. The accepted minimum standard EBCT for PFOS/PFOA removal is approximately 10 minutes. The EBCT for the GAC filter to quench residual hydrogen peroxide from the Advanced Oxidation system is approximately 4 to 5 minutes. This is well below the proposed EBCT of approximately 11 minutes for PFC adsorption in the GAC filters. The GAC filtration pilot system design criteria are shown in Table No. 4-2.

Table No. 4-2
GAC Filtration Process Parameters

Name		Parameter
Number of Filters:		2
Filter Diameter:		6”
Filter Cross-Sectional Area:		0.2 ft^2
Base Flow rate:		1.2 gpm
Base Loading Rate:		6.4 gpm/ ft^2
Media:	GAC	3’ depth
Duration:		10 days plus extended run period
Mode:		Continuous Regeneration

4.10 LayneOx™, Advanced Oxidation, and GAC Filtration Pilot Process

The LayneOx™ manganese dioxide granular filter media pilot unit is presented schematically in Figure No. 4-1. Chlorine is injected into the raw water stream before the filter is used to oxidize the iron and manganese. Oxidized iron and manganese are removed by the physical filter properties of the media while iron and manganese that are not fully oxidized become catalytically precipitated and then adsorbed directly on the media. Chlorine (sodium hypochlorite) will be utilized as the oxidant. Sufficient concentrations of chlorine will be fed to the raw water to perform oxidation and to produce a residual in the treated water. Since the LayneOx™ media is not affected by pH, no pH adjustment is required.

The LayneOx™ pilot process, shown schematically in Figure No. 4-1, consists of chlorine addition and low head filtration. The two filters provide approximately 0.2 square feet of surface area each. The initial flow rate will be set at 1.2 gallons per minute (gpm) producing an average loading rate of 6 gpm per square foot. The optimization period is anticipated to last five days, and the process equipment will operate for an additional 10 days to provide water to the downstream advanced oxidation process. Each filter run will end when either terminal headloss is achieved, breakthrough occurs, or the filter run exceeds 24 hours. Additional runs at higher or lower rates will be completed as well. The LayneOx™ pilot system design criteria are shown in Table No. 4-3.

Table No. 4-3
LayneOx™ Filtration Process Parameters

Name		Parameter
Number of Filters:		2
Filter Diameter:		6”
Filter Cross-Sectional Area:		0.2 ft^2
Base Flow rate:		1.2 gpm
Base Loading Rate:		6.0 gpm/ ft^2
Media:	LayneOx™	3’ depth
	Mesh Size	8x20 US Sieve
Duration:		15 days
Mode:		Continuous Regeneration

Advanced oxidation and GAC filtration pilot processes and parameters will match those described under Section 4.9.

4.11 Extended GAC and Advanced Oxidation Pilot Testing

Upon completion of primary pilot testing, the GAC filters, hydrogen peroxide feed, and UV reactor skid will be operated for up to eight weeks without iron and manganese removal from the GreensandPlus or LayneOx™ filters. The Trojan UV reactor will be piloted since adequate flows will be available without iron and manganese removal. 1,4-dioxane and its byproducts will be sampled at the start of the extended testing, four weeks in, and at the end of the eight-week run period to determine if there is a difference in the treatment provided by the UV system without iron and manganese removal. The UV bulbs will be inspected a minimum of once per week and at the conclusion of the eight-week run period to monitor and document the condition of the UV bulbs. The GAC filters will also be inspected at the conclusion of the eight-week run period to determine any deterioration in performance due to iron and manganese.

4.12 Water Quality Sampling Program

Pilot runs and onsite sample analysis will be performed by Blueleaf, Inc. using their own equipment for filter performance and chemical requirements and equipment provided by

the UV reactor manufacturers. The frequency of field samples will be determined by field conditions and the minimum sampling frequency will be as summarized in Table No. 4-4.

Table No. 4-4
Minimum Field Sampling Frequency

Parameter	Source Water	Pretreated Water	Finished Water
Total Iron	2 per source	1 per study	3 per day
Dissolved Iron	1 per source	1 per study	As Needed
Total Manganese	2 per source	1 per study	3 per day
Dissolved Manganese	1 per source	1 per study	As Needed
Free Chlorine	None	1 per study	2 per day
Total Chlorine	None	1 per study	2 per day
pH	2 per day	2 per day	2 per day
Turbidity	None	None	Continuous

In addition to field tests, when pilot systems are operating at optimal conditions (for minimum of two runs per process previously specified), iron, manganese, PFOS/PFOA, and 1,4-dioxane samples will be collected for a minimum of two runs and sent to a State Certified laboratory for analysis prior to the start of the pilot run (raw water) and once at the end of the pilot run. A total of four samples will be analyzed for each pilot process.

An additional set of raw and finished water samples will be taken during one of the pilot runs. One raw water sample will be taken prior to the filters/treatment equipment and one finished water sample will be taken from each media/process. Samples will be analyzed for the following parameters at a minimum.

- Turbidity
- pH
- Color (apparent and true)
- Alkalinity
- Total Organic Carbon (TOC)
- Sodium
- Sulfate
- Nitrate
- Temperature
- Hardness

Field analysis of backwash water samples from the GreensandPlus filters and LayneOx™ filters will be completed for total suspended solids, settleable solids, and settling times.

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OFFICE LOCATIONS:
MA | NH | CT | ME | VT | AZ | TX

800-366-5760
www.tataandhoward.com

Appendix B

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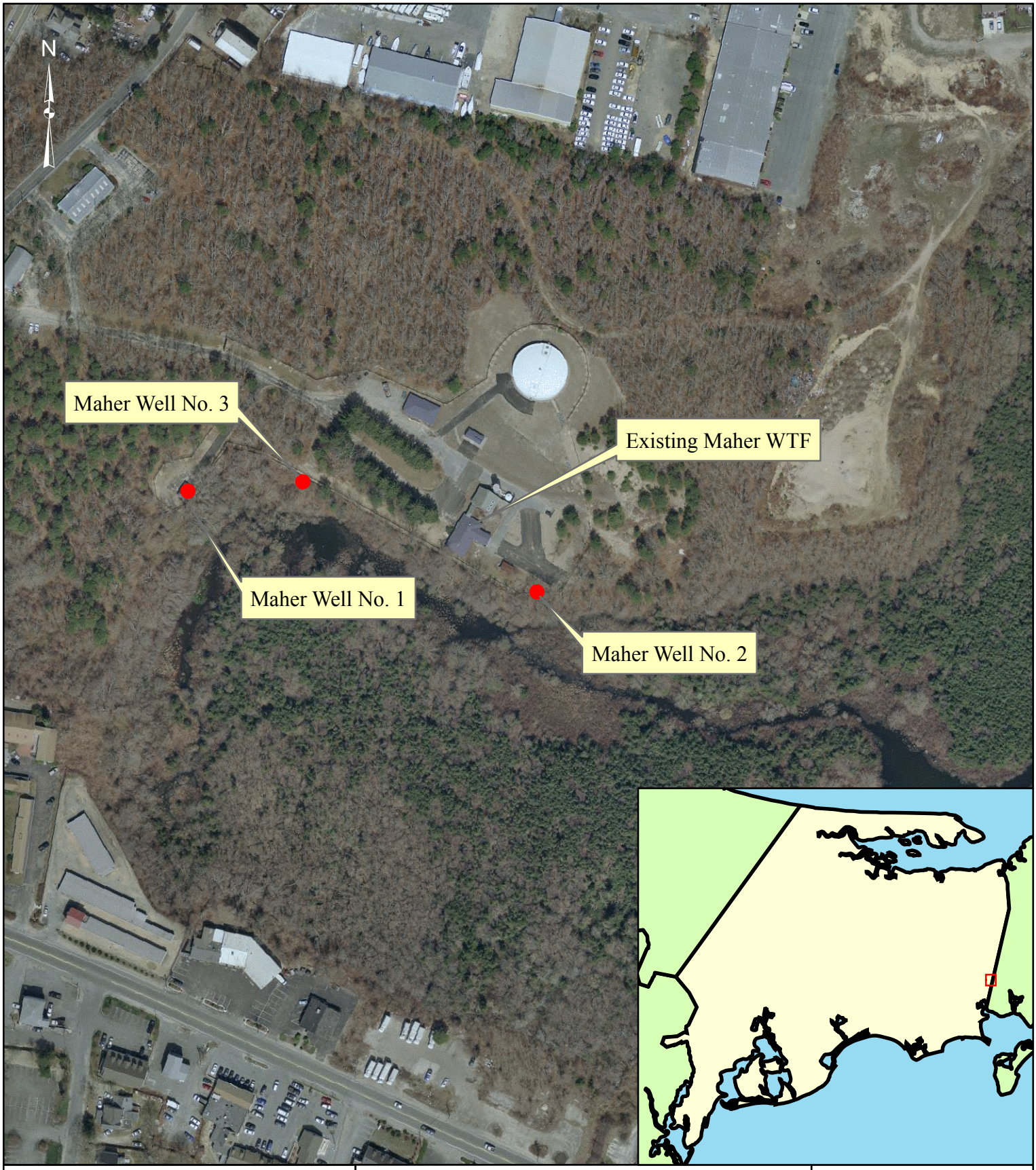

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Date: January 2018
Approximate Scale: 1" = 200'

Site Map

Maher Filtration Plant
Pilot Test Report
Barnstable, MA

Appendix

B

Appendix C

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Blueleaf, Inc.

RESEARCH · INVESTIGATE · EXPERIMENT · SOLVE · AUDIT · ANALYZE · EXPLORE · INSPECT · EVALUATE · CHARACTERIZE · DEMONSTRATE · PILOT

PILOT STUDY REPORT FOR

IRON AND MANGANESE REMOVAL BY PRESSURE FILTRATION

1,4 DIOXANE REMOVAL BY ADVANCED OXIDATION WITH UV

PFOS/PFOA REMOVAL BY ADSORPTION WITH GAC CONTACTORS

COMPLETED AT
TOWN OF BARNSTABLE DPW
WATER SUPPLY DIVISION
MAHER WELLS, BARNSTABLE, MA

JULY-SEP 2017

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Submitted: October 27, 2017

SUMMARY

This report details the methods and results of a pilot study conducted at the Maher Wells in Barnstable, Massachusetts for the evaluation of treatment processes for the removal of iron, manganese, 1,4-Dioxane, and perfluoroctanoic acid and perfluorooctane sulfonates (PFOS/PFOA). The pilot study was conducted for the Town of Barnstable DPW Water Supply Division under the direction of the consulting engineering firm Tata and Howard.

The study was performed from July 17, 2017 through September 28, 2017. The average raw iron and manganese concentrations as measured by field analyses during the pilot study are shown in Table 0.01. Raw iron was similar to historical data provided, while raw manganese was greater than the historical data provided.

Table 0.01: Average Raw Iron and Manganese Concentrations, from Field Analyses

Source	Total Iron (mg/L)	Total Manganese (mg/L)
Well 1	0.24	0.084
Well 2	0.15	0.069
Well 3	0.07	0.109

During the initial week of the study, all three wells were operated and samples were collected to determine which wells, or combination of wells, would provide the worst-case raw water blend to the pilot processes. Field data was used to estimate the iron and manganese concentrations from each well, and laboratory data was used to estimate the 1,4-Dioxane and PFOS/PFOA concentration. In most cases, Well 3 had concentrations that were lower than the average concentration of the contaminants from the other two wells. Well 3 was not used for pilot testing after July 31. Results of a single sample collected on July 25 showed that the PFOS and PFOA concentrations in Well 3 were similar to the PFOS and PFOA concentrations in Well 1 and 2. The average raw 1,4-Dioxane and PFOS/PFOA concentrations as measured by lab analyses during the pilot study are shown in Table 0.02.

Table 0.02: Average 1,4-Dioxane and PFOS/PFOA Concentrations, from Laboratory Analyses

Source	Total 1,4-Dioxane (µg/L)	PFOS (ng/L)	PFOA (ng/L)	PFOS+PFOA (ng/L)
Well 3 (1 sample)		83.2	18.6	101.8
Well 1 + 2 (11 samples)	0.489	77.6	17.3	94.9

The pilot study evaluated three different treatment processes:

1. Iron and Manganese Removal by Adsorption with Pressure Filtration
2. 1,4-Dioxane Removal by Advanced Oxidation with UV (UV AOP)
3. PFOS/PFOA Removal by Adsorption with GAC Contactors

Two pilot-scale pressure filters containing GreensandPlus™ media and two filters containing LayneOx® media were operated in parallel. A total of 36 individual filter trials were completed. Pilot filtration

trials were performed at Filter Surface Loading Rates of 4 to 6.4 gpm/sf. The raw well water was chemically pretreated with sodium hypochlorite during all trials. Potassium hydroxide was utilized for pH adjustment to 6.8 during all trials.

Both media types were able to reduce iron and manganese in the raw water to concentrations below the regulatory limits (note that raw iron concentrations were already less than the regulatory limit). All four filters appeared to meet all other drinking water standards, including secondary contaminants and disinfection byproducts. Filters were backwashed after 24 hours of runtime, and were not limited by headloss or contaminant breakthrough. The filters were capable of run times in excess of 24 hours at the piloted filter surface loading rates for 4 to 6.4 gpm/sf.

The Trojan UV AOP system was effective in destruction of raw 1,4-Dioxane to concentrations below laboratory detection limits in all 11 samples collected over the 8-week extended run. Hydrogen peroxide dose ranged from 1 to 5 ppm and ballast power ranged from 60 to 100% during the extended run. The average UVT of the UV influent raw water was 99.7%. Weekly inspection of the lamps sleeves showed no visual indication of fouling. UVT analysis of the sleeve itself was conducted by Trojan and the results will be forwarded under separate cover when received. The smaller generic UV system was not capable of proper advanced oxidation and destruction of 1,4-Dioxane.

Two GAC contactors effectively removed PFOS/PFOA during ten weeks of operation to concentrations below the laboratory minimum detection limits. The 6-inch diameter contactors were operated with 36 inches of media providing an empty bed contact time of 11 minutes. During the first three weeks or testing, the GAC contactors were exposed to 1,4-Dioxane because the generic UV AOP system was not effective, and the GAC contactors removed approximately half of the influent 1,4-Dioxane concentration. A properly functioning UV AOP system upstream of the contactors produced water capable of stripping accumulated 1,4-Dioxane from the contactors.

This report has been prepared to describe the methods and results of the field testing performed on this project. This report does not include recommendations for full-scale implementation of any process.

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LIMITATIONS

This pilot test report was prepared for Tata and Howard, Inc. and the Town of Barnstable DPW - Water Supply Division, for the purpose of evaluating treatment of iron, manganese, 1,4-Dioxane, perfluoroctanoic acid and perfluorooctane sulfonate (PFOS/PFOA) from Maher Wells 1, 2 and 3, located at 47 Old Yarmouth Road in Barnstable, MA. The findings provided in this report are based solely on the information contained and referenced herein. All field operations, field analyses, data compilation, data analysis and reporting were completed in a fair and impartial manner and are intended to be an accurate representation of treatment performance. Additional quantitative information regarding the raw water, or other treatment goals and concerns that were not available to Blueleaf, Inc. at the time of the pilot study may result in modification of the stated findings. Note that bench and/or pilot scale studies may not identify issues arising from long-term changes to source water quality, nor predict long-term performance of the treatment processes tested.

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ABBREVIATIONS

1,4 D	1,4-Dioxane
ANOVA	Analysis of Variance
BDL	Below Detection Limit
BW	Backwash
CBW	Composite Backwash (sample)
cf	Cubic foot
FSLR	Filter Surface Loading Rate
gpd	Gallons per Day
gpm	Gallons per minute
gpm/sf	Gallons per minute per square foot (of filter surface area)
gr	Gram
GSP	GreensandPlus™
HP	Horsepower
$KMnO_4$	Potassium Permanganate
L	Liter
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
mg	Milligram
MG	Million Gallons
mg/L	Milligrams per liter
MGD	Million gallons per day
min	Minutes
MRL	Minimum Reporting Limit
N/A	Not available / not applicable
NaOCl	Sodium Hypochlorite
ND	Not detected (at laboratory MRL)
NPDWR	National Primary Drinking Water Regulations (primary standards)
NTU	nephalometric turbidity units
ORSGL	Massachusetts Office of Research and Standards Guidelines
PFOA	perfluoroctanoic acid
PFOS	perfluorooctane sulfonate
PID	Proportional Integral Derivative
RDL	Report detection limit
S.U.	Standard Units
sf	Square foot
SM	Standard Methods
SMCL	Secondary Maximum Contaminant Limit
SSN	Settled supernatant (backwash decant sample)
TSS	Total Suspended Solids

ABBREVIATIONS (continued)

µg/L	Micrograms per Liter (equivalent to ppb)
UV	Ultraviolet

1 INTRODUCTION

1.1 BACKGROUND

The Town of Barnstable DPW Water Supply Division (also known as Hyannis Water) operates eleven ground water wells that provide public drinking water to the Barnstable water system. Maher Wells 1, 2 and 3 are located at 47 Old Yarmouth Road in Barnstable, MA. The Maher Wells contain varying concentrations of 1,4-Dioxane, perfluoroctanoic acid and perfluorooctane sulfonate (PFOS/PFOA). These contaminants exceed the regulatory limits in some circumstances. Specific data is provided in Section 1.2.

The Town is pursuing implementation of new water treatment processes for removal of 1,4-Dioxane and PFOS/PFOA. Additionally, the Town is considering removal of naturally occurring iron and manganese prior to the proposed unit processes in order to avoid possible treatment interferences. The Town retained Tata and Howard to provide consulting engineering services. Tata and Howard hired Blueleaf to perform the pilot study of the three treatment processes:

1. Iron and manganese removal by pressure filtration with adsorptive media.
2. 1,4-Dioxane removal by advanced oxidation process (AOP) with UV.
3. PFOS/PFOA removal by pressure filtration with granular activated carbon (GAC) media.

Tata and Howard prepared and submitted the Pilot Study Protocol to the Southeast Region of the Massachusetts Department of Environmental Protection under Transmittal # X275188. The study conducted complied with the Pilot Study Protocol, and this report describes the methods, and results of the field work in partial fulfillment of the requirements for the overall pilot study. It is anticipated that this report will be appended to a report prepared by Tata and Howard with additional analyses, recommendations, and costs which will fulfill the requirements of MaDEP Policy 90-04.

1.2 RAW WATER QUALITY AND REGULATORY REQUIREMENTS

Raw water quality provided in the Tata and Howard Pilot Study Protocol is summarized in Table 1.01. Raw water quality data from 2015 and 2016 showed that 1,4-Dioxane concentrations for Maher Wells 2 and 3 exceeded the recommended limit of 0.3 µg/L as defined by the Massachusetts Office of Research and Standards Guideline Level (ORSGL). Similarly, Maher Wells 1 and 3 exceeded the recommended USEPA Health Advisory limit for the combined PFOS and PFOA concentration of 0.7 µg/L.

Iron and manganese concentrations were compared to the Secondary Maximum Contaminant Levels (SMCL) of 0.3 mg/L for iron and 0.05 mg/L for manganese per the secondary standards of the National Secondary Drinking Water Regulations (NSDWR). The current Massachusetts Office of Research and Standards Guidelines (ORSGL) has a standard of 0.3 mg/L for manganese. The Secondary Maximum Contaminant Level was used as the pilot study treatment goal for manganese removal.

Table 1.01: Maher Wells Historical Raw Water Quality (2014 - 2016) from Pilot Study Protocol

Date	Parameter	Maher Wells			Maher WTP 100-FT Tap	Regulatory Limit
		Well 1	Well 2	Well 3		
April 2014	Iron (mg/L)				BDL (<0.10)	0.3
July 2015					0.161	
August 2016					BDL(<0.10)	
April 2014	Manganese (mg/L)				0.066	0.05
July 2015					0.037	
August 2016					0.026	
2015	1,4-Dioxane (µg/L)	0.26	0.44	0.36		0.3
2016		0.26	0.82	0.24		
May 2016	PFOS (µg/L)	0.110	0.032	0.073		
	PFOA (µg/L)	0.022	0.0053	0.011		
	Total PFCs (µg/L)	0.132	0.0373	0.084		0.07

Note: Cells highlighted in yellow exceed regulatory limits.

The current water treatment facility provides the following treatment to the Maher Well water before entering the distribution system:

1. Air stripper to volatilize potential VOCs.
2. Carus 1205 for sequestering iron and manganese.
3. Potassium hydroxide (KOH) for pH adjustment and corrosion control.
4. Zinc orthophosphate for corrosion control.
5. Sodium hypochlorite for disinfection.

Currently there is no iron and manganese removal process for the Maher Wells.

1.3 PILOT STUDY GOALS

The goals of the pilot study were as follows:

1. Demonstrate the ability of pressure filtration with adsorptive media, GreensandPlus and LayneOx, to remove iron and manganese to concentrations below the ORSGL limit (0.30 mg/L Mn) and SMCL (0.050 mg/L Mn and 0.3 mg/L Fe).
2. Demonstrate the ability of advanced oxidation process with UV to remove 1,4-Dioxane.
3. Demonstrate the ability of granular activated carbon (GAC) contactors to remove perfluoroctanoic acid and perfluorooctane sulfonate (PFOS/PFOA).
4. Provide water quality that meets both federal and state drinking water quality requirements under representative source water quality conditions.
5. Evaluate operational and performance characteristics such as chemical feed rates and hydraulic loading rates.

1.4 TREATMENT APPROACH

1.4.1 Iron and Manganese Treatment by Adsorptive Media Filtration

The pilot study tested iron and manganese treatment by pressure filtration using Greensand Plus™ and LayneOx® adsorptive filtration media. Raw iron and manganese are typically oxidized by chemical pretreatment before filtration. Oxidation converts dissolved ferrous iron to ferric hydroxide, and dissolved manganese to any of several oxides of manganese (MnO_x). Oxidation can be accomplished with chlorination using sodium hypochlorite or with other alternative oxidants.

The adsorptive properties of the filtration media must be maintained by regeneration. Regeneration consists of exposing the media to an oxidant. With Continuous Regeneration (CR) the oxidant is fed continuously during filtration at a dose that is sufficient to both (1) satisfy the oxidant demand of the raw water, and (2) provide an excess for media regeneration.

Iron precipitates are often large enough to be removed by mechanical filtration, i.e. entrapment within the interstices of the filtration media. Iron can also be removed by adsorption to the filtration media. The manganese precipitates are usually too small to be effectively removed by mechanical filtration. The primary mechanism for manganese removal is adsorption.

Iron and manganese removal are usually not highly sensitive to pH within the normal pH range for drinking water sources. pH control is sometimes necessary for effective treatment at some sites, but this must usually be determined by piloting. pH control is sometimes required for purposes unrelated to contaminant removal, for example to minimize corrosion or leaching within the distribution system.

1.4.2 Advanced Oxidation Process

The Tata and Howard pilot study protocol provides the following description of the advanced oxidation process.

Advanced oxidation uses ultraviolet (UV) light with hydrogen peroxide to remove 1,4-dioxane. UV oxidation is a photochemical process that breaks down chemical constituents into their physiologically-inert component parts. This process includes the addition of hydrogen peroxide to the influent water followed by a photochemical reaction that occurs almost instantly within the UV reactor. The irradiation of hydrogen peroxide by UV light breaks the hydrogen peroxide into two hydroxyl radicals. These highly reactive radicals oxidize 1,4-dioxane, breaking it down into its non-toxic molecular components. In addition, the UV oxidation system is capable of breaking down and reducing the concentrations of pharmaceuticals, personal care products, and volatile organic compounds that may be present in the source water.

Following iron and manganese sequestering (or following the greensand pressure filters at the new Maher Filtration Plant if iron and manganese removal is implemented), water will enter the UV oxidation area where hydrogen peroxide is injected into the water just prior to it entering the UV reactor. After the 1,4-dioxane treatment, the water will exit the UV reactor and enter the GAC filters for PFOS/PFOA removal and quenching of any residual hydrogen peroxide prior to final chemical addition.

During the pilot study, the full impact of iron and manganese removal prior to the advanced oxidation and carbon filtration processes will be evaluated. The pilot study will also determine how the sequestering chemical and the presence of iron and manganese affect the efficiency of the advanced oxidation process for 1,4-Dioxane removal.

1.4.3 PFOS/PFOA Treatment by GAC Filtration

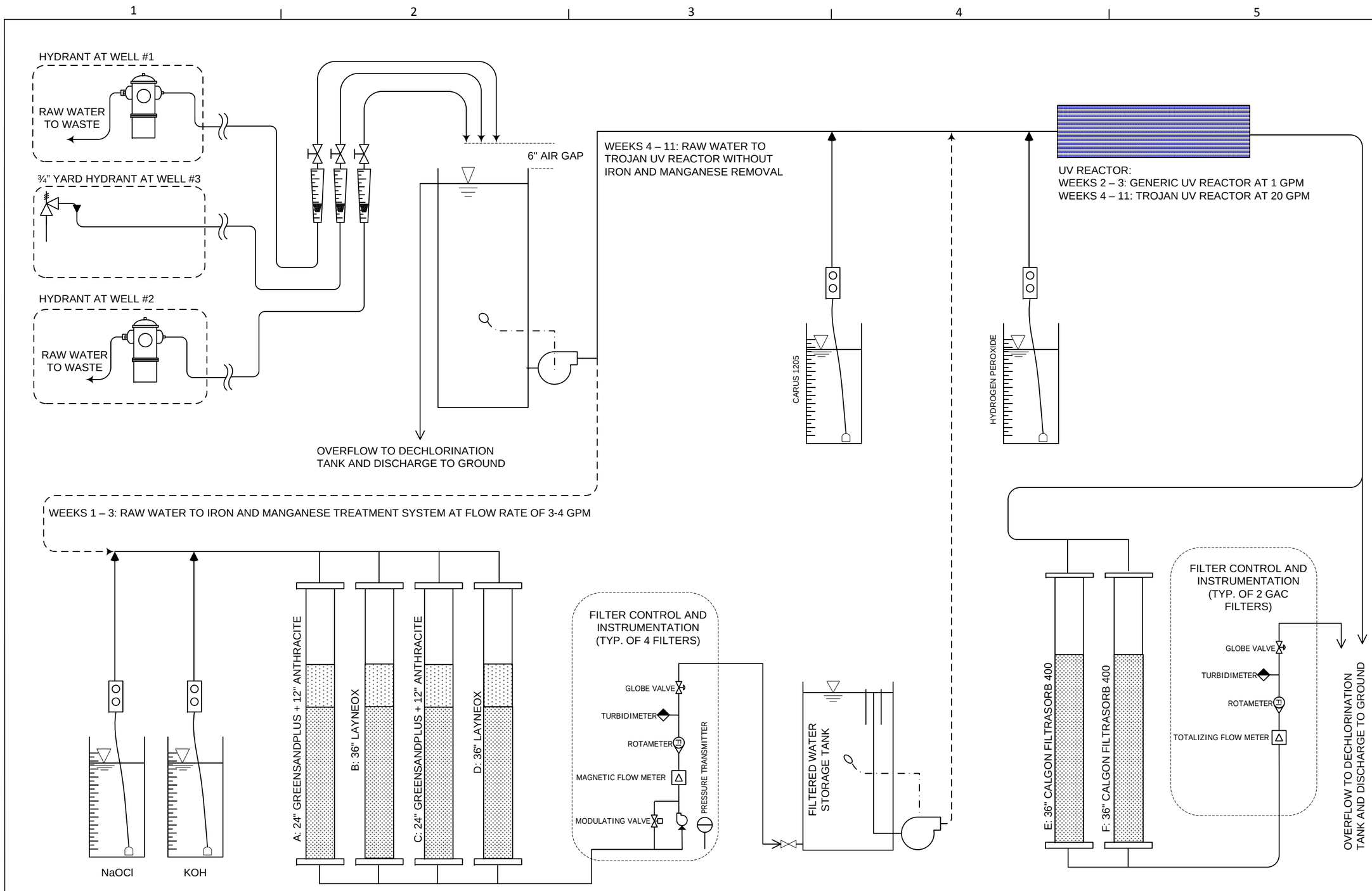
Like adsorptive media filtration for removal of iron and manganese, granulated activated carbon (GAC) filtration has proven to be effective in removal of perfluorooctane sulfonate and perfluoroctanoic acid (PFOS/PFOA) from drinking water. Unlike iron and manganese removal, PFOS/PFOA does not require oxidation to adsorb to the GAC media. The GAC filters also provide a secondary function of quenching any residual hydrogen peroxide from the advanced oxidation process.

2 METHODS AND MATERIALS

Section 2 - Methods and Materials describes the equipment, procedures, and analytical methods utilized during the pilot testing effort.

2.1 PILOT SYSTEMS

Sections 2.1.1 to 2.1.4 describe the three different unit processes piloted at the Maher Water Treatment Facility in Barnstable, MA. A schematic of the comprehensive pilot system is included in Figure 2.01.



PROJECT:
IRON, MANGANESE and 1,4-DIOXANE REMOVAL PILOT STUDY

BLUELEAF, INC
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PILOT TESTING FOR WATER AND WASTEWATER TREATMENT

FIGURE 2.01: PILOT SYSTEM SCHEMATIC

DRAWN BY E. GROTTON
FILE NAME 23614_002
DATE 26JUN2017
SIZE: 11' X 17"
SCALE: 1" = 2'
DWG NO 2.01

2.1.1 Raw Water Supply

Raw water from Maher Wells 1, 2 and 3 were supplied to a blending tank at the pilot site where the flow from each well could be adjusted to blend the sources based on the desired test conditions. Maher Well 1 and Well 2 were supplied from hydrant connections at each well. The wells were operated to waste by SUEZ during the pilot testing to maintain representative flow and water quality but were not utilized by the full-scale facility during the pilot study. Maher Well 3 was supplied from a ¾" yard hydrant sampling connection located at the well. Maher Well 3 was also utilized as the full scale water source during the pilot study and therefore provided representative water. The well connections are shown in Figure 2.02.

Figure 2.02: Maher Wells 1, 2 and 3 Connections

Water from all three wells was supplied to the pilot via 2-inch PVC pipe installed on the ground. The supply piping terminated at the raw water blending tank where flow was controlled by diaphragm valves and 0–10 gpm rotometers. Downstream of the rotometer tubing from the individual wells discharged into the blending tank above the surface of the water in order to maintain a minimum 6-inch air gap. Raw water samples for each well were collected at this location. The tank was equipped with overflow piping to maintain a full volume in the blending tank. The overflow water flowed into the adjacent waste tank. The blending tank and waste tank are shown in Figure 2.03.

Figure 2.03: Blending Tank and Waste Tank

2.1.2 Pressure Filtration with Adsorptive Media

The pilot filtration system and field laboratory were contained in a cargo style trailer, shown set up at the Maher Well Treatment Facility in Figure 2.04.

Blended raw water was supplied to the pressure filter pilot system for iron and manganese removal by a ½ HP booster style feed pump. The feed pump suction was connected to the blended water tank with ¾" nylobraid tubing. Raw water pressure was supplied to the filters at approximately 30 psi. Blended raw water samples were collected from the raw water sample line inside the pilot trailer.

The pilot filtration system included equipment for chemical pretreatment, flow control, four pressure filters operating in parallel, a data acquisition system, and sample points for all relevant sample streams. An interior view of the pilot trailer is shown in Figure 2.05. Pilot filters and chemical feed systems are shown on the right-most photo of Figure 2.05. Control valves and rotameters are shown on the left-most photo of Figure 2.05.

Figure 2.04: Exterior of Pilot Trailer at Maher Well Site

Figure 2.05: Interior View of Pilot Trailer

The influent to the pressure filters was chemically pretreated using sodium hypochlorite (NaOCl) for oxidation of iron and manganese and potassium hydroxide (KOH) for pH adjustment. Potassium hydroxide feed rates were controlled using a Hach SC200 PID controller and 2 pH probes submerged in a constantly flowing water bath supplied with pH adjusted water.

Chemicals were fed using Grundfos diaphragm metering pumps (Figure 2.06). After chemical injection, the pretreated water was distributed to four vertical pressure filters operating in parallel. Chemically pretreated samples (POX) were collected through a sample line at the top of the filters.

Figure 2.06: Chemical Pretreatment Pumps

Four pilot filters were operated in parallel during all trials. Each pilot filter was 6 inches in diameter by 60 inches high. Pilot filters were constructed from 6 inch clear PVC schedule 40 pipe. Each filter had an under drain consisting of a media retention nozzle and a layer of coarse garnet. The media retention nozzles (similar to Johnson well screens) were stainless steel, 2 inches in diameter by 1.5 inch long, with 0.007 inch slot size. Two of the filters contained 24 inches of GreensandPlus^{TM} with 12 inches of anthracite. The anthracite was used as a filter cap to help capture larger particles and maintain the capacity of the media. The two other filters contained 36 inches of LayneOx media.

Flow control for filter service was on the downstream side of the filters. Each filter was provided with a dedicated 0-2 gpm rotameter, 1/2” flow control valve, and ½” pressure reducing valve. A PLC used a PID

control loop to maintain a preset flow rate with modulating rate of flow control valves. Filter flow rates and instrument flow rates through the turbidimeters were periodically measured using a graduated cylinder and stopwatch. Filters were operated at different loading rates during the pilot study to evaluate the relationship between loading rate and filter run time.

Manual pressure gauges monitored raw water pressure on the downstream side of the inlet PRV, and the outlet side of each filter. Additional 1/4" valve sample ports allowed pressure gages to be connected to numerous points throughout the system as needed. These points included the inlet/outlet structures of each filter. Pressure transducers on the common influent manifold to the filters were used to continuously monitor pressure. The differential pressure across each filter was calculated as the difference between the common influent pressure, and the effluent pressure.

Each filter effluent flow had a dedicated flow-through Hach 1720E low range turbidimeter (Figure 2.07). The four effluent turbidimeters were connected to two Hach SC100 2-channel controllers. Filter effluent grab samples were collected from the individual filter effluent streams at the points of discharge into the sample sink. Autosamplers were connected to the effluent lines and programmed to collect grab samples every two hours when the pilot system was not staffed (Figure 2.08).

Figure 2.07: Sample Sink and Hach 1720E low range turbidimeters

Figure 2.08: Autosampler Programmed for Collecting Grab Samples

Filter effluent from the sample sink was discharged by gravity to a 150 gallon Filtered Water Storage Tank outside the pilot trailer. Figure 2.09 shows the Filtered Water Storage Tank. This tank was equipped with a standpipe which allowed overflow to discharge into the waste tank while maintaining a full tank of filtered water. De-chlorination tablets were added to the waste tank before discharging to the ground.

Figure 2.09: Filter Effluent Storage Tank for Backwash

The filters were backwashed using filter effluent stored in the Filtered Water Storage Tank outside the pilot trailer. During a backwash, a booster pump supplied clean water from the filtered water storage tank into the trailer. Backwash flows were controlled on the upstream, clean-water side of the filters while in reverse flow mode. Each filter had a dedicated 0-5 gpm rotameter and flow control valve.

Filters were backwashed individually, one at a time. GreensandPlus™ Filters were backwashed at a nominal flow rate of 2.4 gpm (12 gpm/sf) for 10 minutes. LayneOx™ Filters were backwashed at a nominal flow rate of 4.0 gpm (20 gpm/sf) for 6 minutes. Each filter was backwashed until the backwash volume was 24 gallons, and the entire volume of backwash from each filter was collected in a 30-gallon drum for analysis. Filter backwash samples were collected from the 24-gallon volume after being mixed for 1 minute to form a composite sample.

Table 2.01 summarizes the filter configurations.

Table 2.01: Pilot Filter Configurations

Parameter	**Pilot Filter**			
Pilot Filter	A	B	C	D
Filtration media	GreensandPlus™ with Anthracite	LayneOx™	GreensandPlus™ with Anthracite	LayneOx™
Filtration media bed depth	24”	36”	24”	36”
Anthracite filter cap	12”	0”	12”	0”
Total filter bed depth	36”	36”	36”	36”
Filtration media volume	3 gal	3 gal	3 gal	3 gal
Anthracite volume	1.5 gal	0.0 gal	1.5 gal	0.0 gal
Total media volume	4.4 gal	4.4 gal	4.4 gal	4.4 gal
Support media depth	6”	6”	6”	6”
Freeboard above filter surface	18”	18”	18”	18”
Filter vessel diameter	6”	6”	6”	6”
Filter surface area	0.20 sf	0.20 sf	0.20 sf	0.20 sf
Filter vessel height	60”	60”	60”	60”
Filter vessel volume	7.3 gal	7.3 gal	7.3 gal	7.3 gal

2.1.2.1 GreensandPlus™ Filtration Media (GSP)

GreensandPlus™ (GSP) is a non-proprietary filtration media with the same adsorptive coating and treatment performance as standard manganese greensand, but the adsorptive coating is fused to a silica core. This allows GreensandPlus to withstand higher differential pressures than standard greensand without breakdown of the particles, and without stripping the adsorptive coating from the substrate. GreensandPlus can operate at filter loading rates 8 gpm/sf or greater, depending upon water quality, compared to 2 to 5 gpm/sf for standard manganese greensand.

GreensandPlus has a manganese oxide coating that both catalyzes the oxidation/reduction of manganese, and is adsorptive to manganese. The manganese dioxide coating is maintained by feeding an oxidant, typically either permanganate or chlorine. Pre-oxidation for contaminant removal or disinfection can provide sufficient oxidant to also maintain the adsorptive qualities of the media, but it is sometimes necessary to perform specific media regeneration procedures. Regeneration can be performed continuously by feeding permanganate or chlorine during filter service (continuous regeneration, CR), or intermittently by occasionally backwashing or soaking with permanganate (intermittent regeneration, IR).

GreensandPlus filters are typically backwashed at 12 gpm/sf minutes, with or without air scour. A terminal differential pressure (DP) of 10 psi is often used to trigger backwash, but the manufacturer claims GreensandPlus is capable of withstanding DPs substantially greater than 10 psi.

2.1.2.2 LayneOx Media (GSP)

Layne Christensen of Bridgewater, NJ provided LayneOx™ filtration media. LayneOx is a proprietary filter media that removes oxidized iron and manganese through a combination of adsorption and entrapment. According to the manufacturer, LayneOx also catalyzes oxidation. It is available in two gradations: a coarser 8 x 20 gradation, and a finer 20 x 40 gradation. The pilot study included only the finer 20 x 40 gradation. LayneOx is a homogeneous mineral ore, as opposed to a coated particle

A typical filter is composed of 24 to 48 inches of LayneOx™, with or without an anthracite filter cap. Filter loading rates are typically 8-15 gpm/sf. A terminal differential pressure of 10 psi is recommended. For the 20x40 gradation, the manufacturer recommends backwashing at 25 gpm/sf for 5 minutes without air scour, (alternatively 12-15 gpm/sf for 10 minutes with air scour).

2.1.3 Advanced Oxidation Process with UV

Advanced oxidation was evaluated under two sets of process conditions, (1) after pilot scale iron and manganese removal, and (2) after chemical sequestering of iron and manganese without removal. Because of the two different treatment scenarios two different pilot scale UV systems were necessary during the Barnstable pilot study. A smaller generic system, capable of treating a small volume of water (6 gpm or less) as produced by the iron and manganese treatment system, and a larger system provided by Trojan Technologies, capable of treating flows of 20 gpm and greater. Both systems were contained in a cargo style trailer as shown in Figure 2.10.

Figure 2.10: Exterior of UV/GAC Pilot Trailer at Maher Well Site

The initial phase of UV treatment was conducted for two weeks during the iron and manganese removal trials. A booster pump supplied filtered effluent from the filter effluent storage tank to the generic UV system through ¾" nylobraid tubing. The flow rate through the UV system matched the combined flow of the four pressure filters which was approximately 4 gpm. UV system flow was controlled by a diaphragm valve in combination with a 0–10 gpm rotometer. Hydrogen peroxide was injected into the UV system influent to complete the oxidation process. A portion of the UV system effluent was supplied to the GAC filters while the excess flowed to the waste tank.

The second phase of UV treatment was an extended 8-week trial conducted without iron and manganese removal. A two-inch booster pump supplied raw water to the Trojan UV pilot system. The same sequestering agent as used by the full-scale treatment facility, Carus 1205, was injected into the UV system influent. The sequestering agent was intended to maintain raw iron and manganese in a dissolved state. Hydrogen peroxide was injected into the UV system influent to complete the oxidation process. Chemicals were fed using Grundfos diaphragm metering pumps (Figure 2.11).

Figure 2.11: UV Pretreatment Chemicals

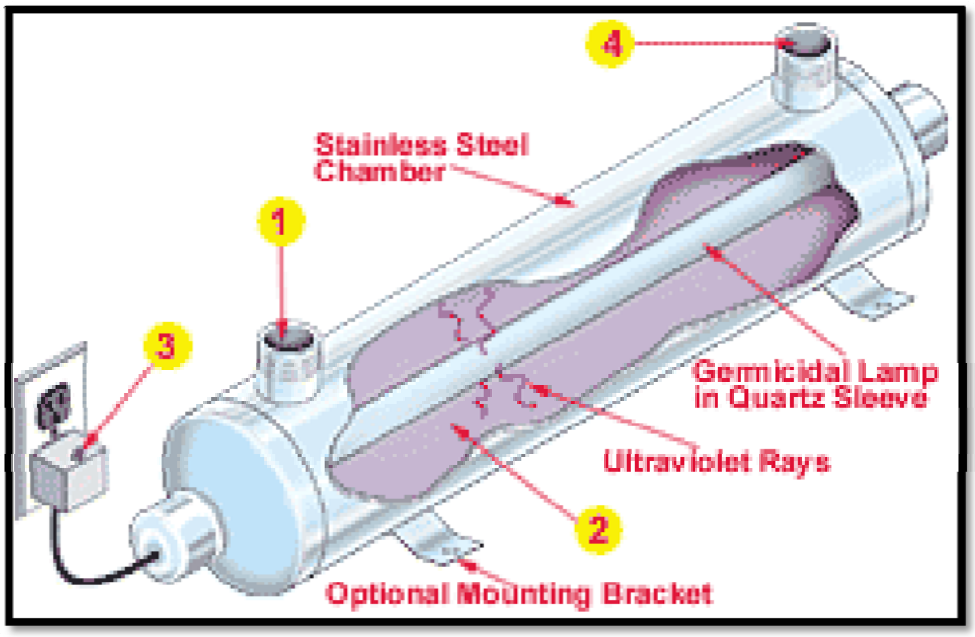
Flow rate was controlled by a diaphragm valve in combination with 0–50 gpm rotometer. A portion of the UV system effluent was supplied to the GAC filters while the remainder flowed to the waste tank. The Trojan UV system was equipped with a control system which allowed adjustments to the power supply for the lamps. The system was also equipped with wipers to clean potential buildup of residue on the lamp sleeves. The wipers were set to operate at a frequency of every two hours during the pilot study. Pilot system instrumentation included a flow meter and UVT analyzer. Blueleaf provided a PLC to record the online flow and UVT measurements during the extended run.

2.1.3.1 Generic UV System for Disinfection

A household sized generic UV system was utilized during the iron and manganese removal trials. The smaller generic unit was utilized during iron and manganese removal trials because the iron and manganese removal pilot system could not produce the flows required to operate the larger specified Trojan UV system.

The generic unit was approximately 15 inches long with a circumference of 4.25 inches and equipped with a 120V 50/60 Hz ballast. Figure 2.12 is a schematic of the unit. Water flows into the stainless-steel disinfection chamber where it is exposed to the germicidal lamp. The exposure time is a function of the flow rate. The UV dosage is the product of the ultraviolet intensity and the exposure time within the chamber.

Figure 2.12: Generic UV System Schematic



2.1.3.2 Trojan Technologies UV System

Trojan Technologies provided the TrojanUVPhox™ 12AL30 UV-Oxidation System. The system required single phase 240-volt power. The reactor chamber was 76 inches x 12 inches diameter and contained 12 amalgam lamps contained in transparent glass sleeves. The pilot system was provided with 3-inch piping and 3-inch influent and effluent flanges for field connections.

The pilot system included a control system with an operator interface screen. Lamp power could be turned on or off or dimmed from the control screen. Lamp sleeves were equipped with a wiper system which was also controlled from the control screen. Pilot system instrumentation included a flow meter and UVT analyzer. Figure 2.13 is a photo of the pilot UV system at the site. Figure 2.14 provides layout drawings for the Trojan UV pilot system.

Figure 2.13: Trojan Pilot UV System Photo

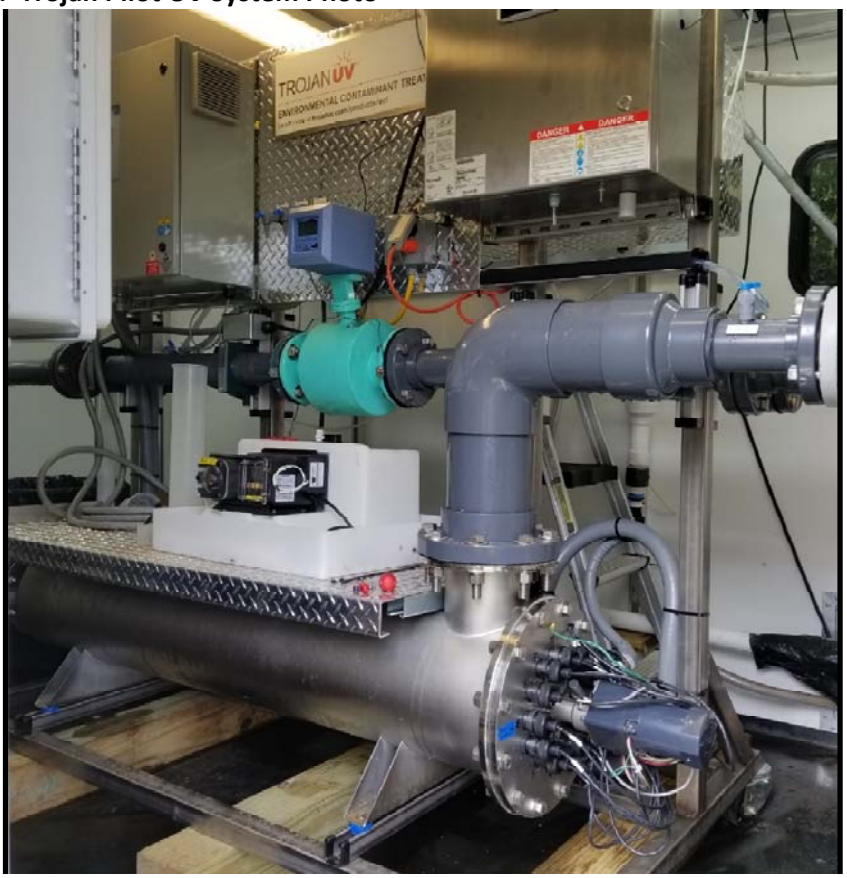
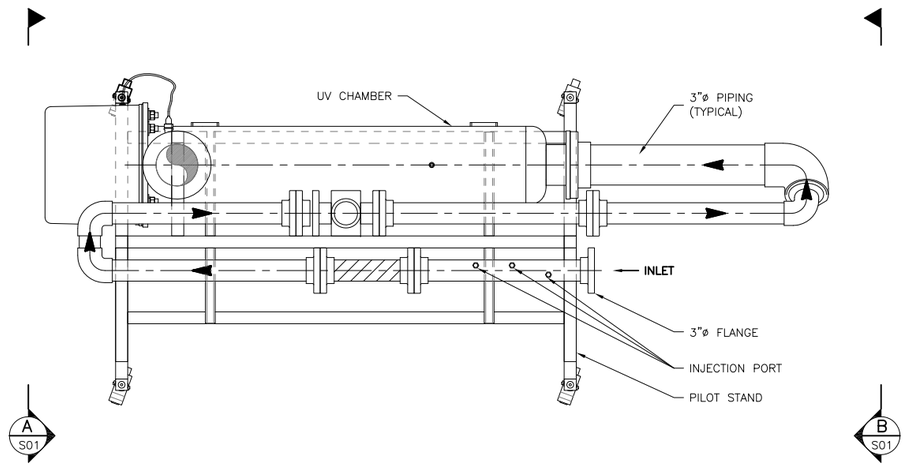
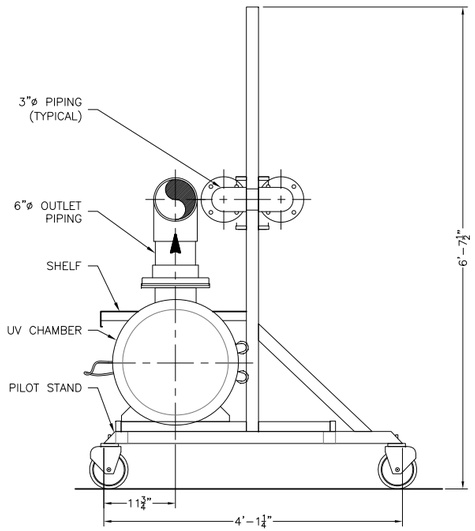


Figure 2.14: Trojan UV Pilot System Layout Drawing



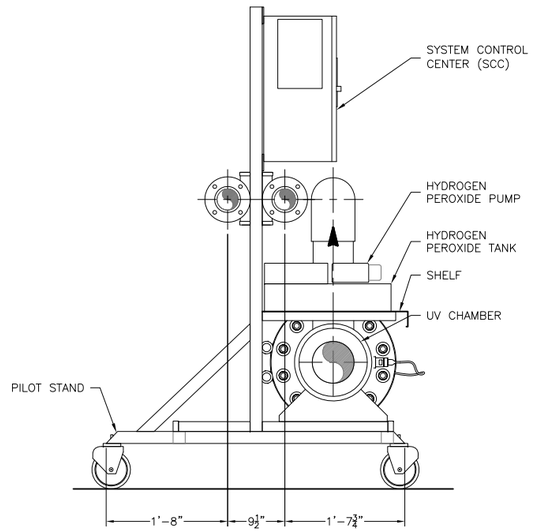
PLAN VIEW

SCALE: NOT TO SCALE
NOTE: SCC, OPTIVIEW™, HYDROGEN PEROXIDE TANK & PUMP, AND SHELF NOT SHOWN FOR CLARITY.



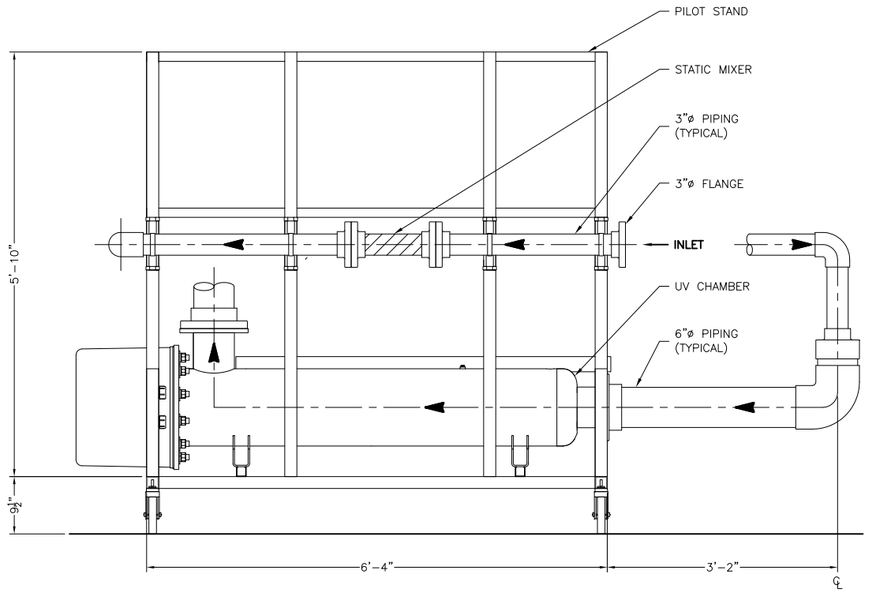
SIDE VIEW A

SCALE: NOT TO SCALE
NOTE: SCC, OPTIVIEW™ AND HYDROGEN PEROXIDE TANK & PUMP NOT SHOWN FOR CLARITY.



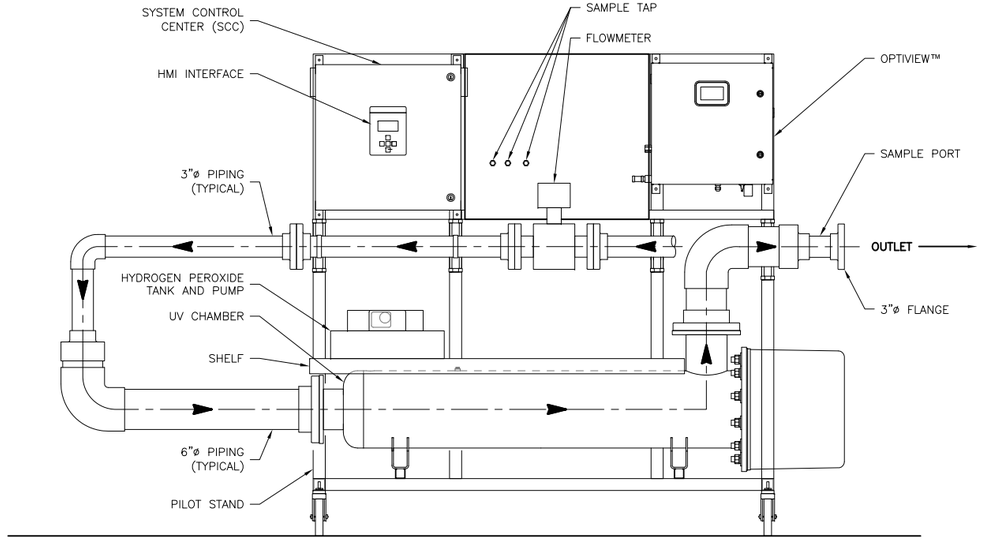
SIDE VIEW B

SCALE: NOT TO SCALE



PANEL VIEW

SCALE: NOT TO SCALE



UV CHAMBER VIEW

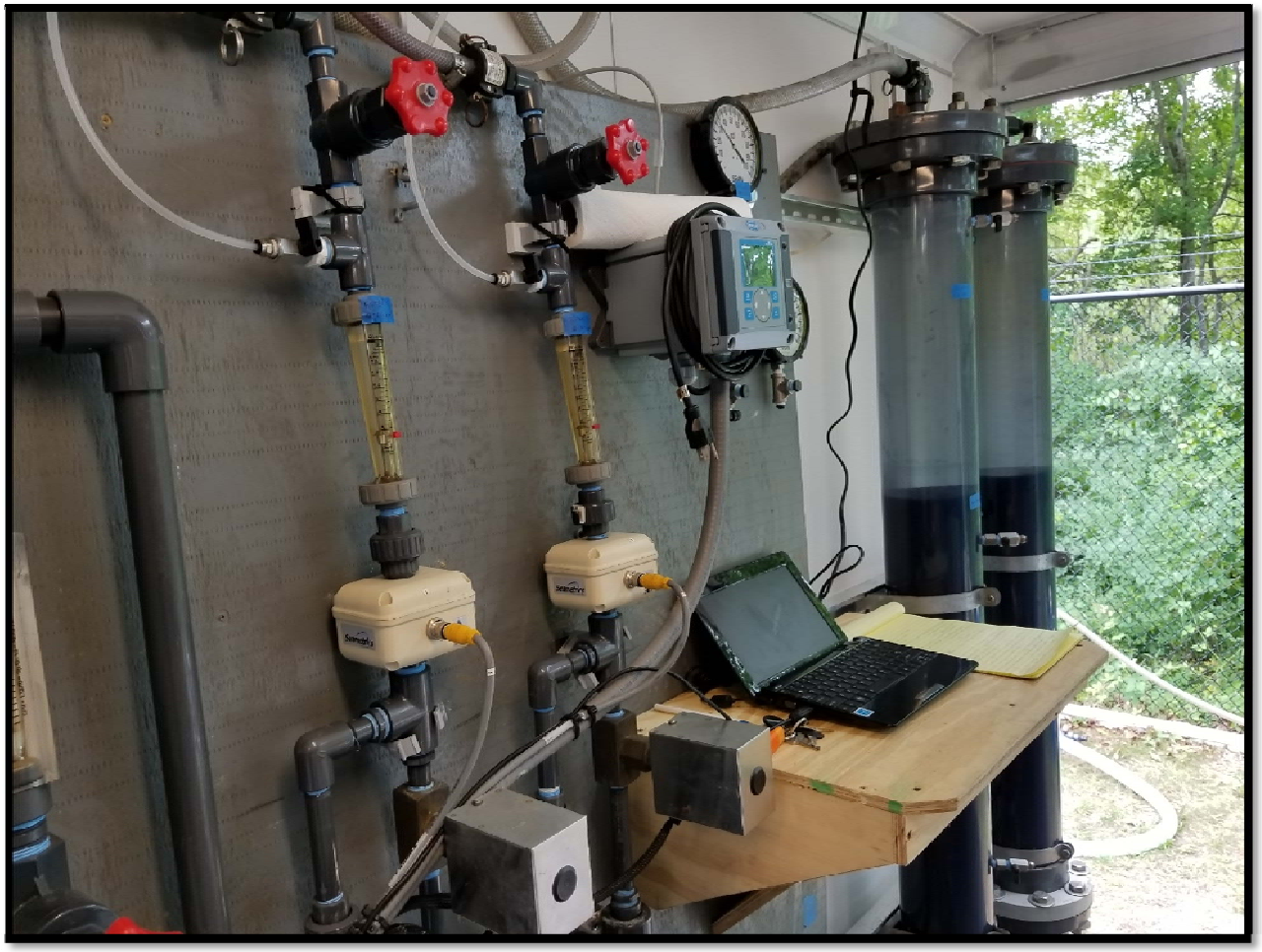
SCALE: NOT TO SCALE

DESCRIPTION:		QUOTE NO. N/A
DRAWN BY : MVW	DATE : 16SE07	PROJECT NO. N/A
CHECKED BY : SPM	DATE : 16SE08	
APPROVED BY : RAH	DATE : 16SE08	DWG NO. S01 / REV. B
SCALE (11x17) : 1/2" = 1'-0"	LOG NUMBER : N/A	

2.1.4 GAC Contactors

The GAC contactors were contained in the same cargo style trailer as the UV system. Figure 2.15 shows the GAC contactor arrangement inside the trailer.

Figure 2.15: GAC Contactors and Controls



Water was supplied to the GAC pressure contactors for PFOS/PFOA removal downstream of UV treatment. During the first phase of piloting, with iron and manganese removal, a booster pump supplied water from the filtered water storage tank to the UV system and the downstream GAC contactors. During the second phase of piloting, without iron and manganese removal, a feed pump supplied blended raw water from the blending tank to the Trojan UV system and downstream GAC contactors. The GAC contactors utilized less water than the UV systems and the overflow portion of UV treated water was diverted to the waste tank. Raw water pressure was supplied to the filters at approximately 30 psi.

The GAC contactors included equipment for flow control, two contactors operating in parallel, a data acquisition system, and sample points for all relevant sample streams. No additional chemical pretreatment was introduced in between UV treatment and the GAC contactors.

Two GAC contactors were operated in parallel during all trials. Each pilot filter was 6 inches in diameter by 60 inches high. Pilot filters were constructed from 6-inch clear PVC schedule 40 pipe. Each contactor had an under drain consisting of a media retention nozzle and a layer of coarse garnet. The media retention nozzles (similar to Johnson well screens) were stainless steel, 2 inches diameter by 1.5-inch long, 0.007 inch slot size. Both filters contained 36 inches of Calgon FILTRASORB® 400.

Flow control for the contactors was on the downstream side of the contactors. Each contactor was provided with a dedicated 0-2 gpm rotameter, 1/2" flow control valve, and ½" pressure reducing valve. A PLC used a PID control loop to maintain a preset flow rate with modulating rate of flow control valves. Contactor flow rates and instrument flow rates through the turbidimeters were periodically measured using a graduated cylinder and stopwatch. Contactors were operated at 11 minutes of empty bed contact time (EBCT) as specified in the protocol.

Manual pressure gauges monitored raw water pressure on the downstream side of the inlet PRV, and the outlet side of each contactor. Pressure transducers on the common influent manifold to the contactors were used to continuously monitor pressure. The differential pressure across each contactor was calculated as the difference between the common influent pressure, and the effluent pressure.

Each contactor effluent flow had a dedicated flow-through Hach 1720E low range turbidimeter. The two effluent turbidimeters were connected to two Hach SC100 2-channel controllers. Filter effluent grab samples were collected from the filtrate turbidimeter feed connections. Contactor effluent flowed to the water tank.

Backwashing of the contactors was not required during the pilot study.

Table 2.01 summarizes the contactor configurations.

Table 2.02: Pilot Filter Configurations

Parameter	GAC Contactors	
Pilot Filter	E	F
Filtration media	Calgon FILTRASORB ® 400	
Filtration media bed depth	36”	
Anthracite filter cap	0”	
Total filter bed depth	36”	
Filtration media volume	3 gal	
Anthracite volume	0.0 gal	
Total media volume	4.4 gal	
Support media depth	6”	
Freeboard above filter surface	18”	
Filter vessel diameter	6”	
Filter surface area	0.20 sf	
Filter vessel height	60”	
Filter vessel volume	7.3 gal	
Flow Rate	0.4 gpm	
EBCT	11 minutes	

2.1.4.1 Calgon Filtrasorb® 400 Granular Activated Carbon (GAC)

Calgons product data sheet describes FILTRASORB ® 400. The data sheet in included in Appendix D.

FILTRASORB 400 is a granular activated carbon for the removal of dissolved organic compounds from water and wastewater as well as industrial and food processing streams. These contaminants include taste and odor compounds, organic color, total organic carbon (TOC), industrial organic compounds such as TCE and PCE, and PFAS. This activated carbon is made from select grades of bituminous coal through a process known as reagglomeration to produce a high activity, durable, granular product capable of withstanding the abrasion associated with repeated backwashing, hydraulic transport, and reactivation for reuse. Activation is carefully controlled to produce a significant volume of both low and high energy pores for effective adsorption of a broad range of high and low molecular weight organic contaminants. FILTRASORB 400 is formulated to comply with all the applicable provisions of the AWWA Standard for Granular Activated Carbon (B604) and Food Chemicals Codex. This product may also be certified to the requirements of ANSI/NSF Standard 61 for use in municipal water treatment facilities. Only products bearing the NSF Mark are certified to the NSF/ANSI 61 - Drinking Water System Components - Health Effects standard. Certified Products will bear the NSF Mark on packaging or documentation shipped with the product.

2.2 CHEMICAL PRETREATMENT

Chemical pretreatment was required for iron and manganese removal and 1,4-Dioxane removal. PFOS/PFOA removal with GAC did not require chemical pretreatment. The liquid pretreatment chemicals were diluted with pilot filter effluent at measured volumetric ratios to produce chemical feed stocks with the desired concentrations. The objective was to maintain chemical feed rates within the mid-range of the feed pumps to allow for dose adjustments as required.

Both GreensandPlus™ and LayneOx™ filter media required oxidation as pretreatment for iron and manganese removal. Sodium hypochlorite was added for oxidation during all filter trials. Table 2.03 summarizes the pretreatment chemical properties. Potassium hydroxide was used for pH adjustment throughout all trials to raise pH to a target of 6.8 for filter effluents. The KOH feed rate was controlled using an online pH probe with a HACH SC200 Controller adjusting the speed of the KOH chemical feed pump using a PID loop. The target setpoint was 6.8.

Advanced oxidation with UV required the addition of hydrogen peroxide upstream of the UV system. The irradiation of hydrogen peroxide by ultraviolet light breaks down the hydrogen peroxide into highly reactive radicals which oxidize the 1,4-Dioxane. During the extended run without iron and manganese removal, a sequestering agent was also added to the raw water prior to UV treatment. The sequestering agent was added to simulate the existing full-scale method of managing iron and manganese. The full-scale sequestering agent, Carus 1205, was provided by SUEZ.

Table 2.03: Pretreatment Chemicals

Product	Formula	Pilot Process	Function	Stock Strength	Specific Gravity
Sodium Hypochlorite	NaOCl	Fe and Mn Removal	Oxidant/Disinfection	8.25%	1.10
Potassium Hydroxide	KOH		pH Adjustment	45%	1.40
Hydrogen Peroxide	H_2O_2	1,4-Dioxane Removal	Advance Oxidation	35%	1.13
Carus 1205	-		Sequesting Fe & Mn	100%	1.31

2.3 FIELD ANALYTICAL METHODS

2.3.1 Field Analyses

Results of field analyses were used to optimize operation of the pilot system and to provide daily operation information for the pilot study. Samples were analyzed in the pilot trailers using the following methods:

2.3.2 Iron - FerroVer

Iron samples for raw water, pilot influent and intermediate filtrations steps were analyzed in accordance with Hach (Loveland CO) FerroVer® method #8008. Samples with iron concentrations above 3.3 mg/L were diluted with distilled water by a ratio appropriate to bring them into a measureable range. Samples were distributed to 25 ml sample vials. FerroVer iron reagent was added to each sample vial and mixed, and 3 minutes were allowed for reaction. The samples were read using a Hach DR 5000, or DR 890 colorimeter. The colorimeter was zeroed with each set of readings using a blank from the appropriate sample site. The estimated detection limit for the method was 0.04 mg/L.

2.3.3 Manganese

Manganese samples were analyzed using the PAN (1-(2 Pyridylazo)-2 Napthol) method in accordance with Hach method #8149. 10 mL samples were measured into 25 ml sample vials. Samples with manganese concentrations above 0.8 mg/L were diluted with distilled water by a ratio appropriate to bring them into a measureable range. Ascorbic acid, alkaline cyanide and 0.1% PAN indicator solution were added using autoburettes set to dispense 0.5 mLs of ascorbic acid, 0.4 mLs of alkaline cyanide, and 0.4 mLs of PAN reagent. The vials were mixed and 2 minutes were allowed for reaction. The samples were read using a Hach DR 5000. The colorimeter was zeroed with each set of readings with a blank of DI water, prepared identically to the samples according to the PAN method. A new blank was prepared with each set of manganese samples that were analyzed. The results were displayed in mg/L of total manganese.

2.3.4 pH Measurements

pH measurements were be made in accordance with Standard Methods 4500-H+B using an Orion glass pH Triode with temperature compensation, and an Orion 3-Star pH meter. A two-point calibration was performed using standard buffer solutions of pH 4.00 SU, and pH 7.00 SU. Calibration was performed each day. Two handheld pH meters were used to make field measurements. Two separate pH meters were utilized for online pH recording and caustic feed pump control.

2.3.5 Chlorine, Free and Total

Chlorine (free and total) samples were prepared in accordance with Hach methods #8021 and #8167, respectively. 10 ml samples were placed in sample vials, and reagents (either total chlorine or free chlorine powder pillows) were added. The total chlorine reagent required a reaction time of 3 minutes. The free chlorine samples were analyzed within 30 seconds following addition of the reagent. The prepared chlorine samples were read using a Hach DR5000. The DR5000 was zeroed before each set of readings with a blank from the appropriate sample site. The estimated detection limit for both methods was 0.02 mg/L.

2.3.6 Turbidity

Turbidity was monitored by Hach Model 1720D turbidimeters installed in the pilot trailer. The turbidmeters were connected to pressurized sample ports via 1/4" OD tubing, and flow rates were controlled by 1/4" ball valves. Sample flow rates were periodically checked and maintained at 100-450 ml/minute. The turbidimeter controllers displayed instantaneous turbidities in Nephelometric Turbidity Units (NTU). The controllers provided a signal to a PC based data acquisition system that recorded data continuously for all turbidimeters.

2.3.7 Hydrogen Peroxide

Hydrogen peroxide concentrations were monitored using a CHEMetrics Hydrogen Peroxide CHEMets® Kit. A CHEMet ampoule is inserted into a 25 mL sample and the tip snapped off. The ampoule will fill with sample. Mix the sample by inverting the ampoule several times. Wipe the ampoule dry and allow 30 seconds for reaction. The presence of hydrogen peroxide will produce an orange color. Compare the ampoule color with the low or high range comparator and record the corresponding concentration.

2.3.8 UV Transmittance

Ultraviolet Transmittance (UVT) was monitored by a Optiview™ online UVT analyzer. UVT refers to the percentage of light that passes through a water sample at the wavelength of 254 nm. UVT relates to the organics, colloidal solids, and suspended particles that absorb and scatter this UV light wavelength. The amount of UV light absorbed by the sample is known as the UV Absorbance (expressed as A_{254}). Absorbance and transmittance are relevant by this logarithmic function $A = \log_{10}(1/T)$. UV light, at wavelength 254 nm, is passed through a path of the water sample. The result is compared to a light intensity measured in pure water and the UVT percentage displayed. The Optiview analyzer provided a signal to a PLC based data acquisition system that recorded data continuously.

2.4 STATISTICAL METHODS

The following statistical analyses were used for evaluation of the pilot study data.

2.4.1 Analysis of Variance (ANOVA)

When appropriate, Minitab software was used to perform an Analysis of Variance (ANOVA) to compare the effects of two or more factors upon a specific response. For example, an ANOVA might be used to compare effluent iron concentrations (the response) at different surface loading rates (the factor). The following explanation was adapted from the software documentation.

An ANOVA tests the hypothesis that the means of two or more populations are equal. The procedure uses variances to determine whether the means are different, by comparing the variance between group means versus the variance within groups. In this way, the ANOVA determines whether the different groups are all part of one larger population, or can be statistically distinguished as separate populations with different characteristics. An ANOVA requires data from normally distributed populations with roughly equal variances between factor levels.

An example of the output from an ANOVA is shown in Table 2.04. The ANOVA tested a data set to determine whether the Factor had a statistically significant affect upon the Response. The Factor had two levels. Level 1 included 22 data points, and Level 2 included 10 data points.

Table 2.04: Example of One-Way ANOVA Response versus Factor with Two Levels

```
Source  DF        SS        MS       F      P
Trial    1  0.071783  0.071783  234.91  0.000
Error   30  0.009167  0.000306
Total   31  0.080950

S = 0.01748   R-Sq = 88.68%   R-Sq(adj) = 88.30%   Pooled StDev = 0.01748

                            Individual 95% CIs For Mean Based on
                            Pooled StDev
Level   N     Mean    StDev  ------+---------+---------+---------+---
1      22  0.12318  0.02009                                    (-*-)
2      10  0.02100  0.00876  (--*--)
                            ------+---------+---------+---------+---
                                0.030     0.060     0.090     0.120
```

The most important aspects of the ANOVA are described below.

2.4.1.1 Null Hypothesis

The ANOVA determines whether the null hypothesis should be accepted or rejected. For all ANOVAs herein, the null hypothesis and its alternative hypothesis were as follows:

- The Null Hypothesis (Ho) states that all population means are equal.
- The Alternative Hypothesis (H_1) states that at least one population mean is different.

If the null hypothesis is rejected, it indicates that the population means were different, and it follows that the Factor had a statistically significant affect upon the Response. If the null hypothesis is accepted, then it follows that the factor did not have a significant effect upon the response.

2.4.1.2 Probability Value

The probability value (p-value) reports the probability that the null hypothesis can be accepted. The p-value is tested against an alpha value (α), often called the level of significance. Alpha was chosen to be 0.05 (5%) for all ANOVAs herein. If the p-value is greater than alpha ($p>0.05$) then there was greater than 5% probability that the population means were the same (or alternatively less than 95% probability that the means were different) and the null hypothesis cannot be rejected. If the p-value is less than alpha ($p<\alpha$), then the null hypothesis can be rejected, and it can be concluded that at least one mean is different than the others to a certainty of >95%.

In the example above, the p-value was 0.000, which indicates <0.1% probability that the null hypothesis is correct, or conversely >99.9% probability that the null hypothesis can confidently be rejected.

2.4.1.3 Confidence Intervals

A confidence level of 95% was chosen for all ANOVAs herein. The ANOVA output includes a plot of the 95% confidence intervals. For each data set (Levels 1 and 2) the asterisk (*) indicates the mean value, and 95 out of 100 data fall within the 95% confidence interval indicated between the parentheses.

In the example above, there is no overlap of the confidence intervals. The data sets corresponding to Level 1 and Level 2 are clearly different. This indicates that the Factor at Levels 1 and 2 had a significant effect upon the response.

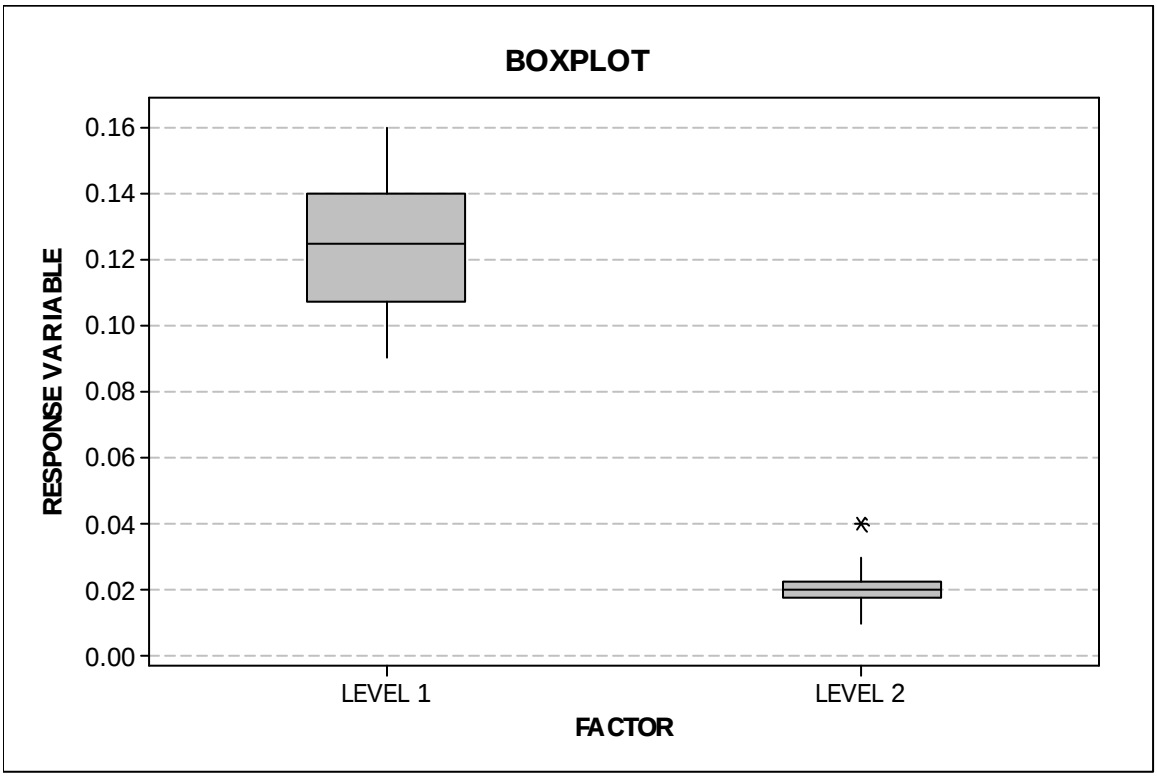
2.4.1.4 Mean and Standard Deviation

The ANOVA reports the mean, standard deviation, and sample count (N) for each data set. In the example above, Level 1 had a mean of 0.123 and a standard deviation of 0.020, while Level 2 had a mean of 0.021 and a standard deviation of 0.009. Level 2 had a lower mean and a smaller standard deviation than Level 1.

2.4.2 Boxplots

Boxplots are used to provide a graphical summary of the distribution of a sample. Minitab can include a boxplot as part of the output of an ANOVA. A boxplot shows the shape, central tendency, and variability of the sample. Figure 2.16 was from the same data used for the ANOVA example, above. One factor was tested at two levels. The boxplot shown here suggests that Level 2 resulted in a lower median response than Level 1, and also had a narrower range of variation than Level 1.

Figure 2.16: Boxplot Example



The important aspects of the boxplot are described below:

1. The upper whisker extends to the maximum data point within 1.5 box heights from the top of the box.
2. The interquartile range box contains the middle 50% of the data.
    a. The top line indicates the third quartile (Q3). 75% of the data are less than or equal to this value.
    b. The middle line indicates the median (Q2). 50% of the data are less than or equal to this value, and 50% of the data are greater than this value.
    c. The bottom line indicates the first quartile (Q1). 25% of the data are less than or equal to this value.
3. The lower whisker extends to the minimum data point within 1.5 box heights from the bottom of the box.
4. An asterisk (*) denotes an outlier, an observation that is beyond the upper or lower whisker.

2.5 EXPERIMENTAL PLAN AND SCHEDULE

The pilot study evaluated three different treatment processes for removal of three different contaminants groups.

For **iron and manganese removal** a total of nine experimental trials were completed on each of the four filters for a total of 36 individual filter trials. An acclimation trial (Trial 1) was completed from July 17th through July 18th using Well 3 at the base loading rate of 4 gpm/sf. During this time, chemical pretreatment doses were optimized, and the filter media allowed to acclimate to the pretreated raw water. Wells 1 and 2 were started up by SUEZ on July 19th allowing a blend of all three wells at the start of Trial 2. Well 2 failed overnight and was out of service until it was repaired and restarted on July 31st. Trials 3 through 7 were operated with Wells 1 and/or 3. Trials 8 and 9 were operated with Wells 1 and 2 only to provide the most challenging water source.

Filter surface loading rates were targeted at 4 gpm/sf to 6.4 gpm/sf during the filter trials. During most trials each pair of filters were operated with one at the lower loading rate and one at the higher loading rate. Online data logging was not available for the start of Trial 1 nor at the end of Trial 9 due to technical issues. All other trial periods had online data logging capability.

1,4-Dioxane removal with UV was conducted in two phases. The first using a small scale generic UV system using filtered water from the iron and manganese removal pilot system. The second phase utilized the larger Trojan UV system to treat raw water.

PFOS/PFOA removal with GAC was conducted downstream of UV treatment during both phases of UV treatment. The GAC contactors operated continuously for the full pilot duration and did not require backwashing due to turbidity breakthrough or excess headloss.

Table 2.05 is a summary of the trials and operating conditions for all the treatment system piloted for the duration of the study.

Table 2.05 Filter Operation Summary

Iron and Manganese Removal Pressure Filtration with Adsorptive Media							1,4-Dioxane Removal Advanced Oxidation with UV						PFOS/PFOA Removal GAC Contactors			
Date	Filter Trial	Source	Filter Column	KOH	NaOCl	Filter Surface Loading Rate (gpm/sf)	UV Trial	UV System	UV Source	UV Flow Rate	H_2O_2	Carus 1205	GAC Trial	Source	Contactor	EBCT (min)
7/17 - 7/18	1	Well 3	A	Target pH 6.8	Target Residual 0.5 mg/L	4.21 ± 0.47 [50]										
			B			3.99 ± 0.43 [50]										
			C			4.40 ± 0.48 [50]										
			D			4.90 ± 0.55 [50]										
7/19 - 7/20	2	Well 1 Well 2 Well 3	A			4.05 ± 0.42 [549]										
			B			5.62 ± 0.74 [549]										
			C			4.21 ± 0.43 [549]										
			D			5.62 ± 0.66 [549]										
7/20 - 7/21	3	Well 1 Well 3	A			5.28 ± 0.96 [500]										
			B			6.02 ± 1.00 [500]										
			C			5.89 ± 0.85 [500]										
			D			5.90 ± 0.72 [500]										

Table 2.05 Filter Operation Summary (continued)

Iron and Manganese Removal Pressure Filtration with Adsorptive Media							1,4-Dioxane Removal Advanced Oxidation with UV						PFOS/PFOA Removal GAC Contactors			
Date	Filter Trial	Source	Filter Column	KOH	NaOCl	Filter Surface Loading Rate (gpm/sf)	UV Trial	UV System	UV Source	UV Flow Rate (gpm)	H_2O_2 (ppm)	Carus 1205 (ppm)	GAC Trial	Source	Contactor	EBCT (min)
7/24 - 7/24	4	Well 3	A	Target pH 6.8	Target Residual 0.5 mg/L	5.80 ± 1.11 [216]	1	Generic	Iron and Manganese Filter Effluent	4	5	0	1	Generic UV System Effluent	Filter E	11
			B			5.76 ± 1.12 [216]										
			C			6.01 ± 1.12 [216]										
			D			5.89 ± 1.14 [216]										
7/25 - 7/25	5	Well 3	A			6.25 ± 0.93 [108]										
			B			5.78 ± 0.92 [108]										
			C			6.06 ± 0.94 [108]										
			D			6.16 ± 0.92 [108]										
7/26 - 7/28	6	Well 1 Well 3	A			5.94 ± 0.32 [977]										
			B			5.80 ± 0.34 [977]										
			C			6.07 ± 0.34 [977]										
			D			5.85 ± 0.37 [977]										
7/28 - 7/31	7	Well 1 Well 3	A			5.67 ± 0.23 [1497]									Filter F	
			B			5.79 ± 0.25 [1497]										
			C			5.89 ± 0.24 [1497]										
			D			5.94 ± 0.23 [1497]										
7/31 - 8/01	8	Well 1 Well 2	A			3.94 ± 0.15 [456]										
			B			3.58 ± 0.39 [456]										
			C			6.25 ± 0.26 [456]										
			D			6.15 ± 0.06 [456]										
8/01 - 8/04	9	Well 1 Well 2	A			3.82 ± 0.15 [927]										
			B			3.73 ± 0.27 [927]										
			C			6.24 ± 0.47 [927]										
			D			6.27 ± 0.36 [927]										
8/07 - 9/06							2	Trojan 100% Lamps	Well 1 Well 2	20	5	1.75	2	Trojan UV System Effluent	Filter E	11
9/06 - 9/29							3	Trojan 60% Lamps			1	1.75			Filter F	

3 RESULTS

Section 3 presents the data and results collected during the pilot study.

3.1 RAW WATER QUALITY

The blended raw water pilot source varied over the course of the pilot study. The blended source utilized by Trial is summarized in Table 3.01.

Table 3.01: Raw Water Blends by Trial

Maher Wells Utilized			Trial	Notes
1	2	3		
Yes	Yes	Yes	1	All three wells initially utilized.
Yes	Yes	Yes	2	Well 2 failed overnight during Trial 2.
Yes	No	Yes	3	Well 2 being repaired.
No	No	Yes	4	Well 2 being repaired. Well 1 not restarted.
No	No	Yes	5	
Yes	No	Yes	6	Well 2 being repaired. Well 1 restarted.
Yes	No	Yes	7	
Yes	Yes	No	8	Well 2 repairs complete and restarted. Determination made to pilot only Wells 2 and 3 for remainder of study due to highest contaminant levels.
Yes	Yes	No	9	
Yes	Yes	No	Extended UV Run	

Tables 3.02 to 3.05 summarize the results from field and laboratory analyses of raw water from Maher Wells 1, 2 and 3 and the raw water blends utilized by the pilot study. Figures 3.01 and 3.02 plot the iron and manganese data, respectively, for the duration of the pilot study. Both field and laboratory results for iron and manganese are presented. Figure 3.03 plots the 1,4-Dioxane and PFOS/PFOA concentrations as reported by the certified laboratory for the duration of the study.

Table 3.02: Raw Water Quality from Field Analyses

Parameter	**Median** (Min – Max) [Sample Count]					
	Well 1	Well 2	Well 3	Well 1 – 2 – 3 Blend	Well 1 – 3 Blend	Well 1 – 2 Blend
Iron, total (mg/L)	**0.17** (0.08-0.69) [10]	**0.15** (0.10-0.19) [4]	**0.04** (0.02-0.04) [13]	**0.51** (0.27-0.74) [2]	**0.11** (0.01-0.34) [11]	**0.14** (0.04-0.39) [11]
Manganese, total (mg/L)	**0.086** (0.041-0.135) [10]	**0.046** (0.025-0.046) [4]	**0.105** (0.088-0.141) [13]	**0.154** (0.150-0.157) [2]	**0.092** (0.026-0.108) [11]	**0.045** (0.032-0.125) [11]
pH (s.u.)	**5.85** (5.68-5.99) [10]	**6.03** (5.99-6.06)[2]	**5.67** (5.26-6.09) [20]	**6.02** (5.96-6.39) [12]	**5.69** (5.57-5.98) [12]	**5.83** (5.67-6.02) [14]

Table 3.03: Laboratory Raw Water Quality Results

Filter Trial	5	9	9	9	UV Extended Run											
Lab Report #	L1725482	L1726666	L1726977	L1727204	L1727347	L1728130	L1729058	L1729617	L1730552	L1731241	L1732361	L1733478	L1734538			
Date/Time	7/25/17	8/2/17	8/3/17	8/4/17	8/7/17	8/11/17	8/18/17	8/23/17	8/30/17	9/6/17	9/13/17	9/20/17	9/27/17			
Source	**Well 3**	**Well 1 & 2**	**Well 1 & 2**	**Well 1 & 2**	**Well 1 & 2**	**Well 1 & 2**	**Well 1 & 2**	**Well 1 & 2**	**Well 1 & 2**	**Well 1 & 2**	**Well 1 & 2**	**Well 1 & 2**	**Well 1 & 2**	**Units**	**RL**	**Analytical Method**
Iron, Total	ND (<0.05)	0.060	0.058	0.063	0.080	0.057	0.062	0.087	0.089	0.087	0.096	0.069	0.065	mg/L	0.050	19,200.7
Iron, Dissolved		ND												mg/L	0.050	19,200.7
Manganese, Tot	0.1154	0.042	0.040	0.044	0.051	0.050	0.050	0.050	0.053	0.052	0.048	0.053	0.051	mg/L	0.0010	19,200.7
Manganese, Dis		0.043												mg/L	0.0010	19,200.7
pH	5.4	6.4	5.8	6.3	6.0	6.2	6.2	5.4	6.1	5.6	6.4	6.2	5.8	SU	-	121.4500
Alkalinity, Total	10.0	15.0	15.5	15.7	15.2	14.4	13.1	13.1	13.8	13.2	13.2	13.5	13.0	mg/L	2.00	121.2320B
Turbidity	ND (<0.20)	ND (<0.20)	ND (<0.20)	ND (<0.20)	0.22	ND (<0.20)	0.22	0.39	0.30	0.49	0.52	0.20	0.31	mg/L	0.20	44,180.1
1,4-Dioxane			0.628	0.590	0.594	0.661	0.518	0.553	0.461	0.407	0.152	0.412	0.403	µg/L	0.147	EPA 522
PFOA	18.6		16.9	18.2	ND (<1.85)	21.3	20.5	17.4	20.7	17.8	20.2	18.3	17.0	ng/L	1.85	EPA 537
PFOS	83.2		80.2	87.8	86.2	93.4	82.3	77.1	72.5	68.5	72.8	67.6	65.4	ng/L	1.85	EPA 537
Bromate		ND (<1.0)			ND (<1.0)	ND (<1.0)	ND (<1.0)	ND (<1.0)	ND (<1.0)	ND (<1.0)	ND (<1.0)			µg/L	1.0	317.0

Table 3.04: Laboratory Raw Water Quality Results – Additional Analyses

Filter Trial	9			
Lab Report #	L1726666			
Date/Time	8/2/17			
Source	**Well 1 & 2**	**Units**	**RL**	**Analytical Method**
Odor @ 60^{o} C	No Odor	TON	1	30,2150B
Color, True	ND	A.P.C.U.	5.0	121,2120B
Color, Apparent	ND	A.P.C.U.	5.0	121,2120B
Carbon Dioxide	130	mg/L	2	121,4500CO2
Total Dissolved Solids	42	mg/L	10	121,2540C
Cyanide	ND	mg/L	0.005	121,4500CN
Fluoride	ND	mg/L	0.20	121,4500F
Nitrogen, Nitrate	0.25	mg/L	0.10	44,353.2
TOC	0.510	mg/L	0.500	121,5310C
Surfactants, MBAS	ND	mg/L	0.050	121,5540C
Coliform, Total	Positive	col/100 ml	-	121,9223B
Escherichia Coli	Negative	col/100 ml	-	121,9223B
Chloride	22.0	mg/L	0.500	44,300.0
Sulfate	10.0	mg/L	1.00	44,300.0
MBTE	ND	µg/L	0.50	VO by GC/MS
Hardness	23.5	mg/L	0.660	19,200.7

Table 3.05: Laboratory Raw Water Quality Results – Additional Analyses - Metals

Filter Trial	9			
Lab Report #	L1726666			
Date/Time	8/2/17			
Source	**Well 1 & 2**	**Units**	**RL**	**Analytical Method**
Aluminum	ND	mg/L	0.100	19,200.7
Antimony	ND	mg/L	0.0040	3,200.8
Arsenic	ND	mg/L	0.0010	3,200.8
Barium	0.0102	mg/L	0.0010	3,200.8
Beryllium	ND	mg/L	0.0010	3,200.8
Cadmium	ND	mg/L	0.0002	3,200.8
Calcium	4.86	mg/L	0.100	19,200.7
Chromium	ND	mg/L	0.0030	3,200.8
Copper	ND	mg/L	0.010	19,200.7
Magnesium	2.76	mg/L	0.100	19,200.7
Mercury	ND	mg/L	0.0002	3,245.1
Nickel	ND	mg/L	0.0020	3,200.8
Potassium	ND	mg/L	2.50	19,200.7
Selenium	ND	mg/L	0.0050	3,200.8
Silver	ND	mg/L	0.007	19,200.7
Sodium	13.9	mg/L	2.00	19,200.7
Thallium	ND	mg/L	0.0010	3,200.8
Zinc	ND	mg/L	0.050	19,200.7

Figure 3.01: Raw Water Iron Concentrations for Maher Wells

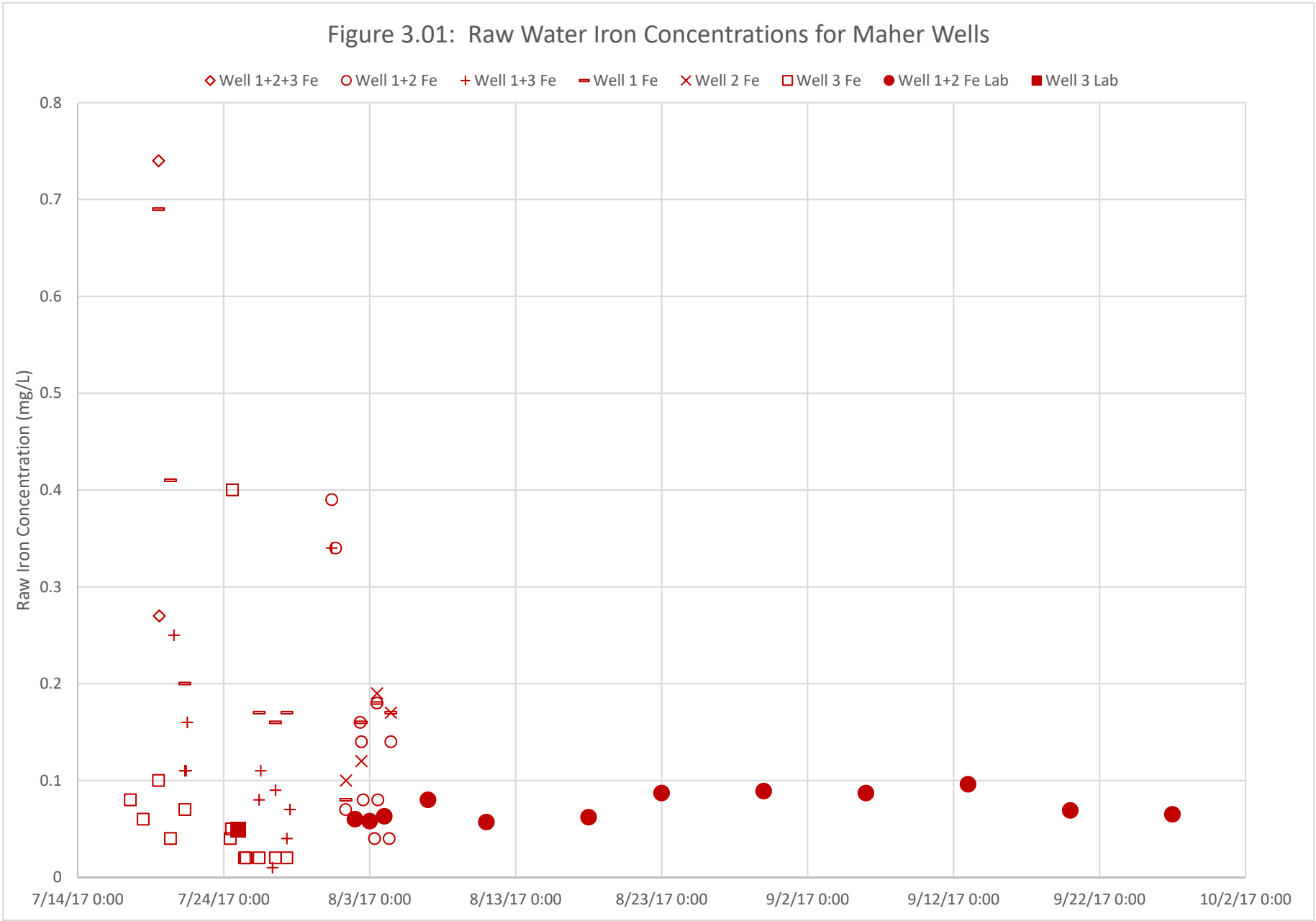


Figure 3.02: Raw Water Manganese Concentrations for Maher Wells

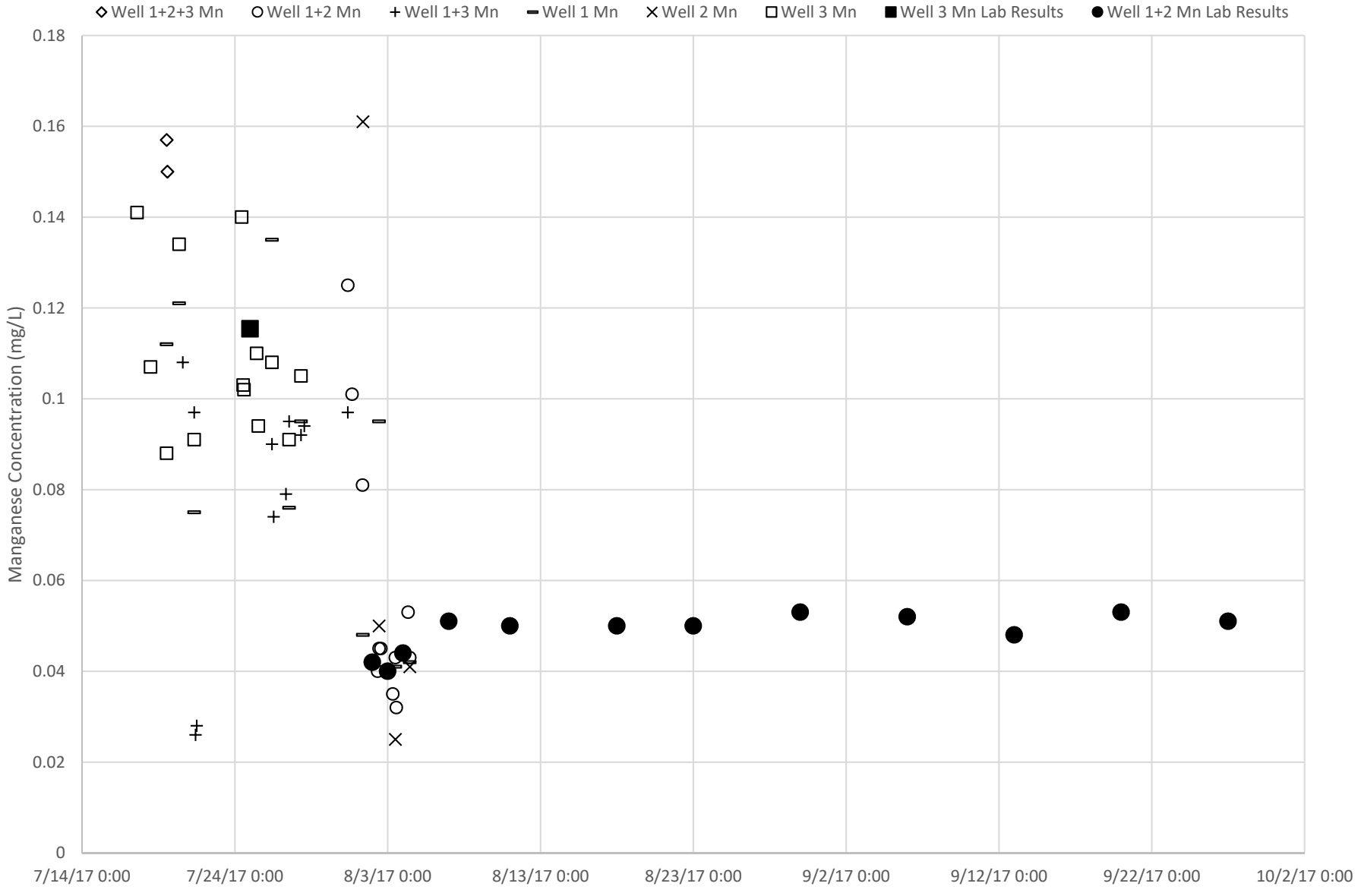
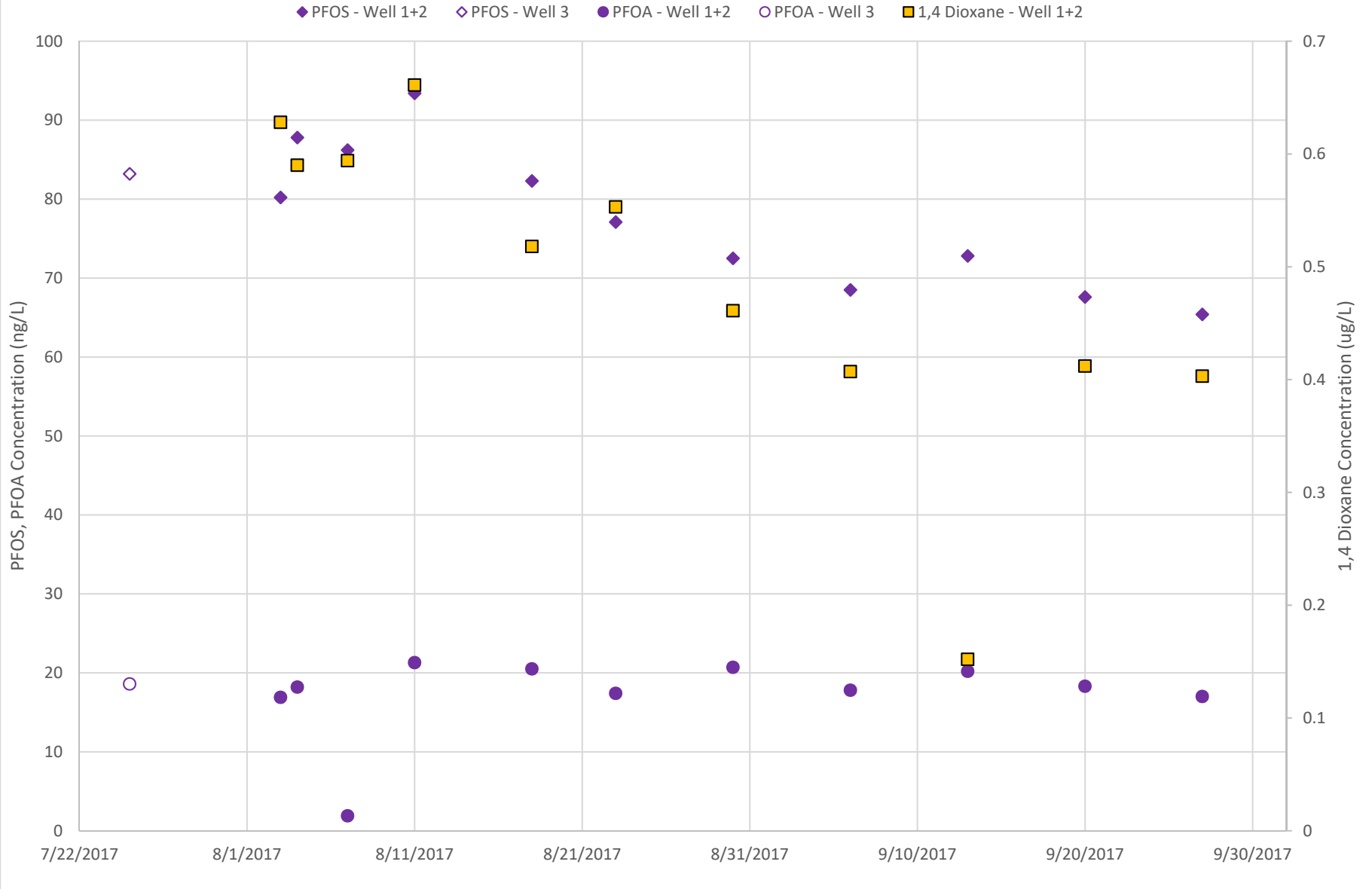


Figure 3.03: Raw Water PFOS, PFOA and 1,4 Dioxane Concentrations for Maher Wells



Raw water quality observations:

- Median iron concentrations for each of the wells and combinations were generally between 0.10 and 0.20 mg/L. The initial Well 1+2+3 combination had higher concentrations shortly after startup of Wells 1 and 2. Water was noticeably turbid and orange in color after startup. The Well 1+2 combination utilized for the 8-week UV extended run stabilized at a concentration of just under 0.1 mg/L.
- Median manganese concentrations for each of the wells and combinations were generally between 0.05 and 0.10 mg/L. The Well 1+2 combination utilized for the 8-week UV extended run stabilized at a concentration of near 0.05 mg/L.
- The median raw water pH was between 5.67 and 6.03 for the three wells.
- Raw water 1,4-Dioxane concentration was near 0.50 µg/L during the study.
- Raw water PFOS concentration was near 80 ng/L during the pilot study.
- Raw water PFOA concentration was near 20 ng/L during the pilot study.

3.2 PRETREATMENT

3.2.1 Pretreatment for Iron and Manganese Removal

Raw water was treated with sodium hypochlorite (NaOCl) for oxidation and potassium hydroxide (KOH) for pH control during piloting for iron and manganese removal.

3.2.1.1 Chemical Doses

The combined influent flow for all filters (Filters A, B, C, and D) was pretreated with KOH and NaOCl. The combined flow rate ranged from 3 to 5 gpm with all filters operating. Nominal filter surface loading rates of 4.0, 6.0 and 6.4 gpm/sf were evaluated.

Doses were calculated with available data and summarized in Table 3.06 by Trial. Chlorine doses are reported in units of mg/L of Cl_2, not NaOCl. Doses are calculated based on chemical usage by monitoring day tank volumes or by using pump feed rate settings.

Table 3.06: Iron and Manganese Removal Pretreatment Doses

Trial	Filters A, B, C, D	
	Cl_2 Dose (mg/L)	KOH Dose (mg/L)
1	Not Measured	
2	1.0	32.2
3	1.2	
4	Not Measured	
5		
6	1.6	
7	1.8	35.4
8	1.3	31.1
9	1.8	35.2

3.2.1.2 Pretreated Water Quality Data (Filter Influent)

Samples of the chemically pretreated raw water were collected downstream of the chemical injection locations, and upstream of the filters. Results from field analyses for total chlorine, free chlorine and pH are shown in Table 3.07. All four filters received the same pretreated water throughout the pilot study.

Table 3.07: Pretreated Water Samples, Field Analyses (collected from common feed line)

Trial	Total Chlorine (mg/L)	Free Chlorine (mg/L)	pH
1	No Data [0]	No Data [0]	No Data [0]
2	0.73 (0.20-0.94) [3]	1.54 (1.25-6.25) [5]	7.24 (7.05-7.38) [4]
3	0.74 (0.53-0.92) [3]	0.73 (0.49-0.96) [3]	6.68 (6.14-6.81) [6]
4	0.83 (0.74-0.92) [3]	0.70 (0.61-0.79) [3]	6.73 (6.63-7.07) [6]
5	0.85-0.99 [2]	0.62-0.63 [2]	6.65 (6.52-6.75) [4]
6	0.84 (0.82-0.93) [6]	0.65 (0.43-0.83) [6]	6.77 (6.65-6.88) [10]
7	1.07-1.31 [2]	0.75-1.03 [2]	6.63 (6.59-6.67) [4]
8	1.16-1.48 [2]	1.22 (1.06-1.32) [3]	6.60 (6.47-6.68) [4]
9	0.96 (0.74-2.42) [8]	1.20 (0.57-2.26) [11]	6.71 (6.45-6.88) [10]

3.2.2 Pretreatment for 1,4-Dioxane Removal

Raw water was treated with hydrogen peroxide (H_2O_2) for advanced oxidation and a sequestering agent, Carus 1205, during piloting for 1,4-Dioxane removal.

3.2.2.1 Chemical Doses

The Trojan UV system operated consistently at a flow rate of 20 gpm during the pilot study. The peroxide dose was initially set for 5 ppm and operated at that dose for the first 5 weeks of the extended run. The peroxide dose was then reduced to 1 ppm for the remaining 3 weeks of the extended run. The peroxide dose was measured onsite with field test kits. The target dose and measured dose are shown in Table 3.08.

A sequestering agent, Carus 1205, was utilized at by the full-scale plant to maintain iron and manganese in solution. The same product was also added during the pilot. If full-scale iron and manganese removal is not implemented, the facility would continue to utilize a sequestering agent. For this reason, the Carus 1205 was added as a pretreatment chemical during the full duration of the UV extended run. The full-scale facility utilizes a dose in the range of 1.5 to 2.0 ppm. A midpoint dose of 1.75 ppm was targeted during the study.

Table 3.08: 1,4-Dioxane Removal Pretreatment Doses

UV Extended Run	Target Peroxide Dose (ppm)	Measured Peroxide Dose (ppm)	Target Carus 1205 Dose (ppm)
Week 1	5.0	5.0	1.75
Week 2		5.0	
Week 3		3.0	
Week 4		2.5	
Week 5		5.0	
Week 6	1.0	1.0	
Week 7		1.0	
Week 8		1.0	

3.2.3 Pretreatment for PFOS/PFOA Removal

No pretreatment was required for PFOS/PFOA removal.

3.3 TREATED WATER QUALITY

3.3.1 Performance of Pressure Filters for Iron and Manganese Removal

3.3.1.1 Summary Tables for Filter Performance

Tables 3.09 through 3.12 summarize filter performance data for Filters A through D, respectively. Performance data includes filter operating conditions, hydraulic performance data, and the continuously logged filter effluent turbidity data. The filter effluent water quality data are presented separately in Section 3.3.1.3. Data may be presented in any of the following formats:

i. Median (minimum – maximum) [number of samples]
ii. Average ± standard deviation [number of samples]
iii. For sets with only 1 data, the results are presented as: x [1], where x is the individual value.
iv. For sets with only 2 data, the results are presented as: $x_1 – x_2$ [2], where x_1 and x_2 are the individual values.

The following information is tabulated for each filter:

- "Trial" – The Trial number.
- "Fig. No." – The figure number corresponding to the trial. Figures are included in Section 3.3.2.
- "Start Time" – The date and time that the filter run began.
- "End Time" – The date and time that the filter run ended.
- "Trial Duration (hours)" – The total run time of the filter run from Start to End, in hours.
- "FSLR (gpm/sf)" – The actual filter surface loading rate being processed through the filter, in gpm/sf. This was calculated using recorded online flow rates, divided by the surface area of the pilot filter (0.196 sf for each filter). The data are presented as average ± standard deviation [sample count].
- "Differential Pressure vs. Runtime" – The parameters of the linear regression on the DP versus Runtime data:
  - » "Slope (psi/hr)" – The slope of the regression line. This is the coefficient "m" in the DP vs. Runtime relationship (y = mx + b) and indicates the time-rate at which DP increases across the filter bed.
  - » "Intercept (psid)" – The y-axis intercept of the regression line. This is the coefficient "b" in the DP vs. Runtime relationship (y = mx + b) and indicates the initial clean bed DP at the start of filter service operations (runtime = 0 hours).
  - » "R-SQ" – The coefficient of multiple determination for multiple regression.
- "Runtime to 10 psi" – The estimated runtime (in hours) to develop a DP of 10 psid, based on the regression equation: $Runtime\ (hours) = (10\ psi - b) \div m$
- "Runtime to Breakthrough (hours)" – The observed filter runtime until the filter reached contaminant breakthrough. Breakthrough never occurred during any of the filter trials, therefore there are no data in these columns.
- "All Turbidity Data (NTU)" – Statistics of all the turbidity data collected during the filter run, including data from initial post-backwash operation, spikes resulting from process disturbances, and post-breakthrough data. The data are presented as average ± standard deviation [sample count].

- "Representative Turbidity Data (NTU)" – Statistics of the representative turbidity data, excluding the presumed filter-to-waste post-backwash period, the post-breakthrough period, and spikes related to identifiable operational upsets. The data are presented as average ± standard deviation [sample count].

The figure numbers are also included in Tables 3.09 and 3.12, to allow comparison of the figures to the operational, water quality, and filter performance data.

Table 3.09: Filter A Performance Data (Pre-oxidation with NaOCl)

Trial	Fig. No.	Description	Start Time	End Time	Trial Duration (hours)	FSLR (gpm/sf)	Differential Pressure vs. Runtime			Runtime to 10 psi (hours)	Runtime to Break-through (hours)	All Turbidity Data (NTU)	Representative Turbidity Data (NTU)
							Slope (psi/hr)	Intercept (psi)	R-SQ				
Trial 1, Filter A	C-1	Well #1-3, FLR 4 w/ Cl_2 – GSP & Anthracite	07/17/17 13:00	07/18/17 10:48	21.8	4.21 ± 0.47 [50]	0.0496	0.4246	0.6737	193.0	-	0.123 ± 0.295 [51]	0.044 ± 0.011 [35]
Trial 2, Filter A	C-5	Well #1-3, FLR 4 w/ Cl_2 – GSP & Anthracite	07/19/17 09:30	07/20/17 12:54	27.4	4.05 ± 0.42 [549]	0.0404	1.4818	0.2771	210.8	-	0.064 ± 0.104 [549]	0.049 ± 0.037 [520]
Trial 3, Filter A	C-9	Well #1+3, FLR 6 w/ Cl_2 – GSP & Anthracite	07/20/17 13:00	07/21/17 13:57	24.9	5.28 ± 0.96 [500]	0.0066	1.7062	0.0131	1260.1	-	0.051 ± 0.084 [500]	0.040 ± 0.005 [490]
Trial 4, Filter A	C-13	Well #3, FLR 6 w/ Cl_2 – GSP & Anthracite	07/24/17 08:15	07/24/17 19:00	10.7	5.80 ± 1.11 [216]	-0.0093	1.8573	0.0260	-874.8	-	0.043 ± 0.006 [212]	0.043 ± 0.006 [212]
Trial 5, Filter A	C-17	Well #3, FLR 6 w/ Cl_2 – GSP & Anthracite	07/25/17 08:39	07/25/17 14:00	5.3	6.25 ± 0.93 [108]	-0.0339	1.9496	0.1116	-237.4	-	0.056 ± 0.084 [108]	0.041 ± 0.003 [103]
Trial 6, Filter A	C-21	Well #1+3, FLR 6 w/ Cl_2 – GSP & Anthracite	07/26/17 08:42	07/28/17 09:30	48.8	5.94 ± 0.32 [977]	0.0063	1.7132	0.3834	1306.7	-	0.043 ± 0.016 [977]	0.042 ± 0.006 [972]
Trial 7, Filter A	C-25	Well #1+3, FLR 6 w/ Cl_2 – GSP & Anthracite	07/28/17 09:51	07/31/17 12:39	74.8	5.67 ± 0.23 [1497]	0.0076	1.8759	0.4326	1062.2	-	0.040 ± 0.002 [1495]	0.040 ± 0.002 [1494]
Trial 8, Filter A	C-29	Well #1+2, FLR 4 w/ Cl_2 – GSP & Anthracite	07/31/17 15:51	08/01/17 14:36	22.7	3.94 ± 0.15 [456]	-0.0080	1.8853	0.2221	-1009.4	-	0.119 ± 0.051 [456]	0.113 ± 0.038 [437]
Trial 9, Filter A	C-33	Well #1+2, FLR 4 w/ Cl_2 – GSP & Anthracite	08/01/17 14:54	08/04/17 11:45	68.8	3.82 ± 0.15 [927]	0.0016	1.6313	0.0218	5369.9	-	0.053 ± 0.041 [917]	0.048 ± 0.008 [910]

Table 3.10: Filter B Performance Data (Pre-oxidation with NaOCl)

Trial	Fig. No.	Description	Start Time	End Time	Trial Duration (hours)	FSLR (gpm/sf)	Differential Pressure vs. Runtime			Runtime to 10 psi (hours)	Runtime to Break-through (hours)	All Turbidity Data (NTU)	Representative Turbidity Data (NTU)
							Slope (psi/hr)	Intercept (psi)	R-SQ				
Trial 1, Filter B	C-2	Well #1-3, FLR 6 w/ Cl_2 – LayneOx	07/17/17 13:00	07/18/17 10:48	21.8	3.99 ± 0.43 [50]	0.0179	0.4973	0.2798	530.8	-	0.117 ± 0.301 [51]	0.028 ± 0.017 [36]
Trial 2, Filter B	C-6	Well #1-3, FLR 6 w/ Cl_2 – LayneOx	07/19/17 09:30	07/20/17 12:54	27.4	5.62 ± 0.74 [549]	0.1715	1.7724	0.1630	48.0	-	0.193 ± 0.765 [549]	0.048 ± 0.056 [508]
Trial 3, Filter B	C-10	Well #1+3, FLR 6 w/ Cl_2 – LayneOx	07/20/17 13:00	07/21/17 13:57	24.9	6.02 ± 1.00 [500]	0.2110	0.2246	0.0738	46.3	-	0.044 ± 0.038 [500]	0.040 ± 0.008 [493]
Trial 4, Filter B	C-14	Well #3, FLR 6 w/ Cl_2 – LayneOx	07/24/17 08:15	07/24/17 19:00	10.7	5.76 ± 1.12 [216]	-0.0034	1.1889	0.0093	-2556.0	-	0.059 ± 0.335 [212]	0.028 ± 0.006 [207]
Trial 5, Filter B	C-18	Well #3, FLR 6 w/ Cl_2 – LayneOx	07/25/17 08:39	07/25/17 14:00	5.3	5.78 ± 0.92 [108]	0.0067	0.9771	0.0081	1350.6	-	0.086 ± 0.308 [108]	0.032 ± 0.006 [101]
Trial 6, Filter B	C-22	Well #1+3, FLR 6 w/ Cl_2 – LayneOx	07/26/17 08:42	07/28/17 09:30	48.8	5.80 ± 0.34 [977]	0.0257	1.1258	0.8228	346.0	-	0.041 ± 0.026 [977]	0.040 ± 0.007 [971]
Trial 7, Filter B	C-26	Well #1+3, FLR 6 w/ Cl_2 – LayneOx	07/28/17 09:51	07/31/17 12:39	74.8	5.79 ± 0.25 [1497]	0.0319	1.1367	0.9007	278.0	-	0.044 ± 0.038 [1495]	0.042 ± 0.003 [1489]
Trial 8, Filter B	C-30	Well #1+2, FLR 4 w/ Cl_2 – GSP & Anthracite	07/31/17 15:51	08/01/17 14:36	22.7	3.58 ± 0.39 [456]	0.0008	1.0538	0.0008	11362.1	-	0.144 ± 0.227 [456]	0.099 ± 0.033 [402]
Trial 9, Filter B	C-34	Well #1+2, FLR 4 w/ Cl_2 – GSP & Anthracite	08/01/17 14:54	08/04/17 11:45	68.8	3.73 ± 0.27 [927]	-0.0148	1.5076	0.0140	-574.1	-	0.082 ± 0.399 [913]	0.042 ± 0.009 [911]

Table 3.11: Filter C Performance Data (Pre-oxidation with NaOCl)

Trial	Fig. No.	Description	Start Time	End Time	Trial Duration (hours)	FSLR (gpm/sf)	Differential Pressure vs. Runtime			Runtime to 10 psi (hours)	Runtime to Break-through (hours)	All Turbidity Data (NTU)	Representative Turbidity Data (NTU)
							Slope (psi/hr)	Intercept (psi)	R-SQ				
Trial 1, Filter C	C-3	Well #1-3, FLR 4 w/ Cl_2 – GSP & Anthracite	07/17/17 13:00	07/18/17 10:48	21.8	4.40 ± 0.48 [50]	0.0173	0.4712	0.2515	550.7	-	0.084 ± 0.193 [51]	0.038 ± 0.015 [39]
Trial 2, Filter C	C-7	Well #1-3, FLR 4 w/ Cl_2 – GSP & Anthracite	07/19/17 09:30	07/20/17 12:54	27.4	4.21 ± 0.43 [549]	0.0378	0.9165	0.0090	240.1	-	0.056 ± 0.068 [549]	0.044 ± 0.016 [525]
Trial 3, Filter C	C-11	Well #1+3, FLR 6 w/ Cl_2 – GSP & Anthracite	07/20/17 13:00	07/21/17 13:57	24.9	5.89 ± 0.85 [500]	0.0887	0.7003	0.0241	104.8	-	0.040 ± 0.022 [500]	0.038 ± 0.006 [491]
Trial 4, Filter C	C-15	Well #3, FLR 6 w/ Cl_2 – GSP & Anthracite	07/24/17 08:15	07/24/17 19:00	10.7	6.01 ± 1.12 [216]	-0.0114	1.2761	0.0482	-768.0	-	0.041 ± 0.038 [212]	0.035 ± 0.006 [205]
Trial 5, Filter C	C-19	Well #3, FLR 6 w/ Cl_2 – GSP & Anthracite	07/25/17 08:39	07/25/17 14:00	5.3	6.06 ± 0.94 [108]	-0.0366	1.2438	0.1034	-239.4	-	0.065 ± 0.120 [108]	0.038 ± 0.006 [99]
Trial 6, Filter C	C-23	Well #1+3, FLR 6 w/ Cl_2 – GSP & Anthracite	07/26/17 08:42	07/28/17 09:30	48.8	6.07 ± 0.34 [977]	0.0085	1.2082	0.6345	1036.0	-	0.040 ± 0.023 [977]	0.038 ± 0.006 [965]
Trial 7, Filter C	C-27	Well #1+3, FLR 6 w/ Cl_2 – GSP & Anthracite	07/28/17 09:51	07/31/17 12:39	74.8	5.89 ± 0.24 [1497]	0.0148	1.3238	0.7954	587.0	-	0.036 ± 0.004 [1495]	0.036 ± 0.002 [1486]
Trial 8, Filter C	C-31	Well #1+2, FLR 6.4 w/Cl2– LayneOx	07/31/17 15:51	08/01/17 14:36	22.7	6.25 ± 0.26 [456]	0.0071	3.0717	0.0757	980.7	-	0.084 ± 0.022 [456]	0.082 ± 0.018 [437]
Trial 9, Filter C	C-35	Well #1+2, FLR 6.4 w/Cl2– LayneOx	08/01/17 14:54	08/04/17 11:45	68.8	6.24 ± 0.47 [927]	-0.0111	2.7847	0.0097	-650.5	-	0.059 ± 0.148 [881]	0.043 ± 0.012 [902]

Table 3.12: Filter D Performance Data (Pre-oxidation with NaOCl)

Trial	Fig. No.	Description	Start Time	End Time	Trial Duration (hours)	FSLR (gpm/sf)	Differential Pressure vs. Runtime			Runtime to 10 psi (hours)	Runtime to Break-through (hours)	All Turbidity Data (NTU)	Representative Turbidity Data (NTU)
							Slope (psi/hr)	Intercept (psi)	R-SQ				
Trial 1, Filter D	C-4	Well #1-3, FLR 4 w/ Cl_2 – LayneOx	07/17/17 13:00	07/18/17 10:48	21.8	4.90 ± 0.55 [50]	0.0334	0.4420	0.4863	286.3	-	0.140 ± 0.544 [51]	0.044 ± 0.015 [35]
Trial 2, Filter D	C-8	Well #1-3, FLR 4 w/ Cl_2 – LayneOx	07/19/17 09:30	07/20/17 12:54	27.4	5.62 ± 0.66 [549]	0.3461	2.2759	0.4808	22.3	-	0.146 ± 0.713 [549]	0.059 ± 0.102 [526]
Trial 3, Filter D	C-12	Well #1+3, FLR 6 w/ Cl_2 – LayneOx	07/20/17 13:00	07/21/17 13:57	24.9	5.90 ± 0.72 [500]	0.0940	1.0556	0.0289	95.1	-	0.088 ± 0.411 [500]	0.047 ± 0.007 [490]
Trial 4, Filter D	C-16	Well #3, FLR 6 w/ Cl_2 – LayneOx	07/24/17 08:15	07/24/17 19:00	10.7	5.89 ± 1.14 [216]	0.0011	1.5511	0.0005	7537.8	-	0.053 ± 0.043 [212]	0.048 ± 0.006 [209]
Trial 5, Filter D	C-20	Well #3, FLR 6 w/ Cl_2 – LayneOx	07/25/17 08:39	07/25/17 14:00	5.3	6.16 ± 0.92 [108]	-0.0385	1.5158	0.1257	-220.6	-	0.110 ± 0.361 [108]	0.051 ± 0.006 [101]
Trial 6, Filter D	C-24	Well #1+3, FLR 6 w/ Cl_2 – LayneOx	07/26/17 08:42	07/28/17 09:30	48.8	5.85 ± 0.37 [977]	0.0577	1.2055	0.9604	152.5	-	0.049 ± 0.023 [977]	0.049 ± 0.023 [977]
Trial 7, Filter D	C-28	Well #1+3, FLR 6 w/ Cl_2 – LayneOx	07/28/17 09:51	07/31/17 12:39	74.8	5.94 ± 0.23 [1497]	0.0372	1.2576	0.9149	234.7	-	0.047 ± 0.010 [1495]	0.046 ± 0.002 [1487]
Trial 8, Filter D	C-32	Well #1+2, FLR 6.4 w/Cl2 – LayneOx	07/31/17 15:51	08/01/17 14:36	22.7	6.15 ± 0.06 [456]	0.0074	2.1431	0.1088	1060.4	-	0.119 ± 0.037 [456]	0.115 ± 0.029 [437]
Trial 9, Filter D	C-36	Well #1+2, FLR 6.4 w/Cl2 – LayneOx	08/01/17 14:54	08/04/17 11:45	68.8	6.27 ± 0.36 [927]	-0.0065	2.3177	0.0043	-1176.8	-	0.075 ± 0.212 [918]	0.059 ± 0.008 [902]

3.3.1.2 Filter Performance Figures

For each filter run, online data were logged every 3 minutes, and grab samples were collected periodically throughout the day. Two autosamplers were installed to collect grab samples of the filter effluents when the pilot was not attended.

Appendix C includes 36 figures which show important operating conditions and effluent iron and manganese concentrations for each filter run. Figure C.12 in Appendix C is representative of the figures included and is described below:

1. X-axis is presented in units of hours of filter run time, with 0 hours set at the time the filter was placed online. The filter trial shown in Figure C.12 was operated for 24.9 hours
2. All recorded filter effluent turbidity is presented as orange "-". This is all turbidity data collected during the filter trial.
3. Representative filter effluent turbidity is presented as orange squares. This is all the turbidity recorded after the filter-to-waste period, and prior to breakthrough.
4. The filter loading rate is shown as a blue line. Loading rate was calculated from the effluent flow rate and the surface area of the filters (0.2 sf). The FSLR is included in the figures to show when flow rates were stable, when flow rate adjustments were made, and when the filter experienced declining rate conditions.
5. Filter Headloss is shown as a dashed black line in the units of psid. Headloss was calculated from the differential pressure transducer connected to the inlet and outlet of the filter. An exponential line of best fit is shown as a thin black line, and was calculated by Microsoft® Office Excel® for each filter trial. The line of best fit is defined by the equation:

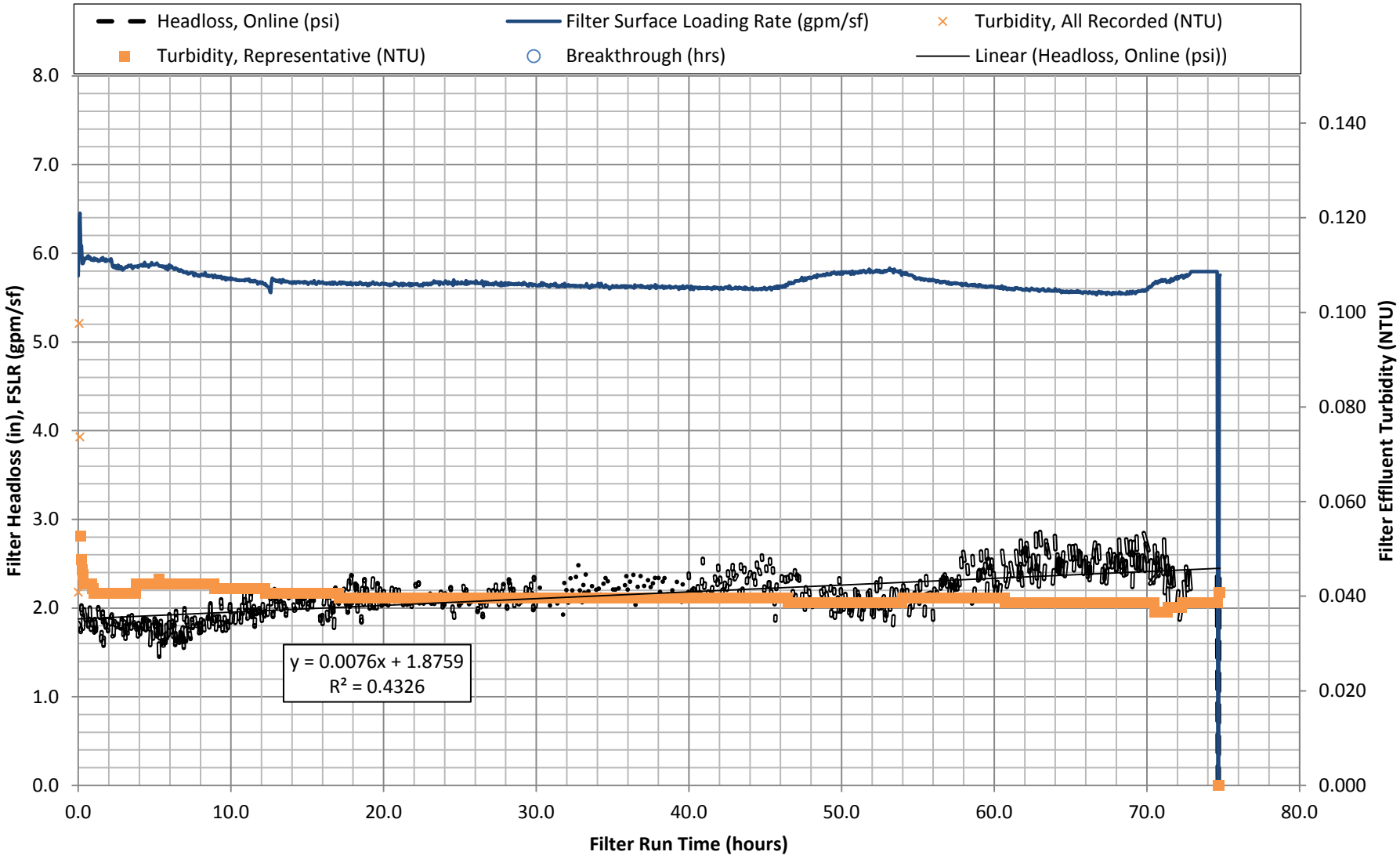
$$y = m \cdot x + B$$

Where: y = Differential pressure (psid) at runtime "x".
m = Slope of the DP/runtime curve, i.e. the time rate increase of DP (psi/hr).
B = The y-intercept of the DP/runtime curve, i.e. the initial clean bed DP (psid).
x = Filter runtime (hours).

The following operational comments are included for the Filter Trials:

- The online data logger was not functioning during Trial 1 and a portion of Trial 9.

Figure 3.04: Filter A Operational Data
Trial 7 - July 28-31, 2017 (Wells 1 & 3)



Filter DP increased as iron and manganese accumulated on the filter media. The rate of DP development is primarily dependent upon contaminant mass loading rates, and fluid velocities. In practice, these factors are mainly affected by FSLR and chemical pretreatment:

- FSLR – higher filter surface loading rates cause higher mass loading rates, assuming constant influent contaminant concentrations. Higher mass loading increases DP by increasing the rate at which contaminant mass is accumulated in the filter (within the interstices, or adsorbed onto media surfaces). There is also a kinetic component to the increased DP, because higher FSLRs result in higher velocities through the media, and higher velocities produce greater losses. As filtered particulates accumulate within the media, the effective cross-sectional area of the filter is decreased still more, which adds to kinetic losses.
- Pretreatment chemicals – Sodium hypochlorite is often sufficient for the complete oxidation and precipitation of dissolved iron at most of the raw water supplies tested. For manganese removal potassium permanganate (which was not used in Barnstable) typically increases the rate of DP development because it (a) contains manganese, which is additional mass that must be removed and retained in or on the filter media, and (2) reacts with the dissolved manganese in the raw water to form a precipitate that is trapped in the media interstices. Sodium hypochlorite typically does not form filterable manganese precipitates (although it may form colloidal-sized precipitates), but oxidizes and/or destabilizes dissolved manganese for effective adsorption to the filtration media. Manganese that enters the media bed in the precipitated state, and is trapped in the media interstices normally created greater DP in the filter bed. KMnO4 both adds to contaminant mass loading, and forms bulkier precipitates that occupy more of the interstitial volume of the filter.

3.3.1.3 Filtered Water Quality

Water quality results from samples analyzed in the field are shown in Tables 3.13 through 3.16. If there are more than two data points in the data set, then the data is presented in the format:

median (minimum – maximum) [number of samples]

If there are only two data points in the data set, the data is presented in the format:

(minimum – maximum) [number of samples]

Laboratory data is presented in Table 3.17 through 3.18, with disinfection byproduct data in Table 3.19.

Table 3.13: Filtered Water Quality from Field Analyses of FILTER A - 24" GreensandPlus + 12" Anthracite (NaOCl only)

Trial #	Free Chlorine Residual (mg/L))	Total Chlorine Residual (mg/L))	Iron, Total (mg/L)	Manganese, Total (mg/L)	pH (s.u.)
Trial 1, Filter A	No Data [0]	No Data [0]	0.040 [1]	0.013 [1]	No Data [0]
Trial 2, Filter A	1.19 (0.55-4.78) [4]	1.03 (0.85-1.15) [3]	0.080 (0.030-0.110) [3]	0.015 (0.007-0.042) [3]	6.99 (6.04-7.31) [6]
Trial 3, Filter A	0.69 (0.37-0.83) [3]	0.58 (0.56-0.76) [3]	0.025 (0.010-0.040) [10]	0.003 (0.000-0.029) [10]	6.66 (6.16-6.80) [8]
Trial 4, Filter A	0.48 (0.38-0.61) [3]	0.63 (0.59-0.75) [3]	0.020 (0.010-0.020) [3]	0.016 (0.000-0.033) [3]	6.82 (6.69-6.94) [6]
Trial 5, Filter A	0.44-0.53 [2]	0.67-0.70 [2]	0.000-0.010 [2]	0.000-0.004 [2]	6.68 (6.65-6.76) [4]
Trial 6, Filter A	0.47 (0.38-0.79) [6]	0.70 (0.66-0.79) [6]	0.015 (0.000-0.040) [10]	0.004 (0.000-0.022) [10]	6.72 (6.48-6.83) [10]
Trial 7, Filter A	0.80-0.86 [2]	1.03-1.11 [2]	0.020 (0.010-0.040) [12]	0.007 (0.000-0.030) [12]	6.51 (6.31-6.71) [4]
Trial 8, Filter A	1.00-1.04 [2]	0.99-1.30 [2]	0.040 (0.000-0.120) [5]	0.019 (0.000-0.049) [5]	6.67-6.82 [2]
Trial 9, Filter A	0.66 (0.33-1.64) [6]	0.87 (0.53-1.80) [6]	0.050 (0.000-0.080) [17]	0.005 (0.000-0.025) [17]	6.78 (6.50-6.86) [10]

Table 3.14: Filtered Water Quality from Field Analyses of FILTER B - 24" GreensandPlus + 12" Anthracite (NaOCl only)

Trial #	Free Chlorine Residual (mg/L))	Total Chlorine Residual (mg/L))	Iron, Total (mg/L)	Manganese, Total (mg/L)	pH (s.u.)
Trial 1, Filter B	No Data [0]	No Data [0]	0.040 [1]	0.015 [1]	No Data [0]
Trial 2, Filter B	0.98 (0.48-5.00) [4]	0.98 (0.67-1.09) [3]	0.060 (0.030-0.060) [3]	0.028 (0.001-0.046) [3]	7.04 (6.07-7.29) [6]
Trial 3, Filter B	0.47 (0.35-0.49) [3]	0.50 (0.45-0.58) [3]	0.020 (0.010-0.030) [10]	0.006 (0.000-0.011) [10]	6.61 (6.25-6.77) [8]
Trial 4, Filter B	0.43 (0.32-0.50) [3]	0.54 (0.52-0.54) [3]	0.010 (0.000-0.010) [3]	0.009 (0.000-0.035) [3]	6.81 (6.69-6.94) [6]
Trial 5, Filter B	0.34-0.35 [2]	0.53-0.53 [2]	0.010-0.010 [2]	0.000-0.009 [2]	6.76 (6.67-6.79) [4]
Trial 6, Filter B	0.40 (0.31-0.66) [6]	0.54 (0.51-0.60) [6]	0.010 (0.000-0.050) [11]	0.007 (0.000-0.020) [11]	6.74 (6.59-6.78) [10]
Trial 7, Filter B	0.61-0.69 [2]	0.73-0.91 [2]	0.010 (0.000-0.030) [13]	0.012 (0.000-0.031) [13]	6.61 (6.48-6.74) [4]
Trial 8, Filter B	0.94-1.17 [2]	1.00-1.31 [2]	0.010-0.100 [2]	0.003-0.048 [2]	6.64-6.66 [2]
Trial 9, Filter B	0.61 (0.44-1.65) [6]	0.90 (0.59-1.90) [6]	0.040 (0.000-0.080) [8]	0.009 (0.000-0.019) [8]	6.78 (6.60-6.85) [10]

Table 3.15: Filtered Water Quality from Field Analyses of FILTER C - 24" GreensandPlus + 12" Anthracite (NaOCl only)

Trial #	Free Chlorine Residual (mg/L))	Total Chlorine Residual (mg/L))	Iron, Total (mg/L)	Manganese, Total (mg/L)	pH (s.u.)
Trial 1, Filter C	No Data [0]	No Data [0]	0.040 [1]	0.024 [1]	No Data [0]
Trial 2, Filter C	1.07 (0.63-51.00) [4]	#REF!	0.080 (0.040-0.120) [3]	0.032 (0.015-0.079) [3]	7.11 (6.07-7.29) [6]
Trial 3, Filter C	0.42 (0.32-0.65) [3]	0.49 (0.45-66.00) [3]	0.025 (0.020-0.030) [4]	0.003 (0.000-0.007) [4]	6.63 (6.19-6.78) [8]
Trial 4, Filter C	0.41 (0.30-0.49) [3]	0.52 (0.50-0.53) [3]	0.020 (0.000-0.020) [3]	0.002 (0.000-0.033) [3]	6.83 (6.69-6.95) [6]
Trial 5, Filter C	0.43-0.43 [2]	0.50-0.50 [2]	0.000-0.000 [2]	0.000-0.010 [2]	6.76 (6.67-6.81) [4]
Trial 6, Filter C	0.38 (0.31-0.50) [6]	0.52 (0.47-0.61) [6]	0.010 (0.000-0.040) [5]	0.001 (0.000-0.022) [5]	6.75 (6.65-6.79) [10]
Trial 7, Filter C	0.62-0.71 [2]	0.76-0.85 [2]	0.030-0.040 [2]	0.011-0.034 [2]	6.62 (6.51-6.72) [4]
Trial 8, Filter C	0.65-0.75 [2]	0.59-0.81 [2]	0.050 (0.000-0.070) [5]	0.013 (0.006-0.033) [5]	6.62-6.63 [2]
Trial 9, Filter C	0.44 (0.13-1.07) [6]	0.54 (0.41-1.32) [6]	0.050 (0.000-0.080) [17]	0.010 (0.000-0.019) [17]	6.79 (6.60-6.87) [10]

Table 3.16: Filtered Water Quality from Field Analyses of FILTER D - 24" GreensandPlus + 12" Anthracite (NaOCl only)

Trial #	Free Chlorine Residual (mg/L))	Total Chlorine Residual (mg/L))	Iron, Total (mg/L)	Manganese, Total (mg/L)	pH (s.u.)
Trial 1, Filter D	No Data [0]	No Data [0]	0.040 [1]	0.014 [1]	No Data [0]
Trial 2, Filter D	1.07 (0.58-3.78) [4]	0.88 (0.68-1.11) [3]	0.050 (0.050-0.060) [3]	0.025 (0.018-0.103) [3]	7.10 (6.13-7.27) [6]
Trial 3, Filter D	0.42 (0.30-0.44) [3]	0.45 (0.40-0.53) [3]	0.020 (0.020-0.030) [4]	0.002 (0.000-0.004) [4]	6.67 (6.60-7.76) [6]
Trial 4, Filter D	0.37 (0.36-0.42) [3]	0.44 (0.43-0.53) [3]	0.010 (0.000-0.100) [3]	0.009 (0.000-0.039) [3]	6.80 (6.70-6.90) [6]
Trial 5, Filter D	0.27-0.43 [2]	0.43-0.50 [2]	0.000-0.010 [2]	0.002-0.002 [2]	6.79 (6.75-6.82) [4]
Trial 6, Filter D	0.34 (0.25-0.49) [6]	0.47 (0.40-0.50) [6]	0.010 (0.000-0.040) [5]	0.000 (0.000-0.023) [5]	6.74 (6.65-6.81) [10]
Trial 7, Filter D	0.52-0.59 [2]	0.64-0.68 [2]	0.010-0.020 [2]	0.006-0.014 [2]	6.66 (6.55-6.72) [4]
Trial 8, Filter D	0.74-0.80 [2]	0.62-0.83 [2]	0.000-0.040 [2]	0.038-0.038 [2]	6.64-6.65 [2]
Trial 9, Filter D	0.42 (0.29-1.00) [6]	0.56 (0.45-342.00) [6]	0.035 (0.000-0.080) [8]	0.016 (0.000-0.022) [8]	6.74 (6.63-6.84) [10]

Table 3.17: Filter Effluent Water Quality Results by Lab Analyses

Filter Trial	5		9				9		9				
Lab Report #	L1725482		L1726666				L1726977		L1727204				
Date/Time	7/25/17		8/2/17				8/3/17		8/4/17				
Filter	**A**	**C**	**A**	**B**	**C**	**D**	**A**	**C**	**A**	**C**	**Units**	**RL**	**Analytical Method**
Iron, Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	mg/L	0.050	19,200.7
Manganese, Tot	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0026	0.0030	<0.010	<0.010	mg/L	0.050	19,200.7
Alkalinity, Total	47.6	48.4	41.1	42.7	43.2	41.1	43.5	42.0	43.6	43.6	mg/L	0.0010	121,2320B
Turbidity	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.23	mg/L	0.0010	44,180.1
pH			6.9	6.8	6.9	6.9			6.9	6.9	S.U.	-	121,4500H+B

Table 3.18: Filter Effluent Water Quality Results – Additional Analyses

Filter Trial	9						
Lab Report #	L1726666						
Date/Time	8/2/17						
Filter	**A**	**B**	**C**	**D**	**Units**	**RL**	**Analytical Method**
True Color	<5.0	<5.0	<5.0	<5.0	col/100 ml	5.0	121,2120B
Apparent Color	<5.0	<5.0	<5.0	<5.0	col/100 ml	5.0	121,2120B
TOC		0.510		0.520	mg/L	0.5	121,5310C
DOC		<1.0		<1.0	mg/L.	1.0	121,5310C
Coliform, Total	Neg	Neg	Neg	Neg	col/100 ml	-	121,9223B
Escherichia Coli	Neg	Neg	Neg	Neg	col/100 ml	-	121,9223B
Carbon Dioxide	200	190	200	180	mg/L	2.0	121,4500CO2
Nitrogen, Nitrate	0.26	0.27	0.26	0.26	mg/L	0.10	44,353.2
Chloride	22.6	22.6	22.5	22.5	mg/L	0.500	44,300.0
Sulfate	9.56	9.54	9.54	9.54	mg/L	1.00	44,300.0
Aluminum	<0.100	<0.100	<0.100	<0.100	mg/L	0.100	19,200.7
Calcium	4.56	4.49	4.60	4.52	mg/L	0.100	19,200.7
Copper	<0.010	<0.010	<0.010	<0.010	mg/L	0.010	19,200.7
Sodium	13.8	13.5	13.6	13.4	mg/L	2.00	19,200.7
Hardness	22.0	21.6	22.2	22.1	mg/L	0.660	19,200.7
Bromate	<1.0	<1.0	<1.0	<1.0	µg/L	1.0	317.0

Table 3.19: Disinfection By-Product Results from Laboratory Analyses during Trial 3

Date	8/2/2017			
Trial	**9**	**9**	**RL**	**Analytical Method**
Filter	**B**	**D**		
Simulated Distribution System Setup				
Incubation Time (Hours)	168	168	-	8,5710C
Initial pH (su)	6.80	6.90	-	8,5710C
Initial Incubation Temp (deg. C)	20	20	-	8,5710C
Initial Chlorine Residual (mg/L)	0.77	1.24	-	Field
Final Total Chlorine Residual (mg/L)	0.56	0.27	0.05	8,5710C
Final Free Chlorine Residual (mg/L)	<0.050	<0.050	0.05	8,5710C
Final pH (s.u.)	7.19	7.10	-	8,5710C
Trihalomethanes				
Chloroform (µg/L)	<0.50	<0.50	0.50	16,524.2
Dibromodichloromethane (µg/L)	2.4	2.2	0.50	16,524.2
Bromodichloromethane (µg/L)	1.4	0.86	0.50	16,524.2
Bromoform (µg/L)	1.2	1.5	0.50	16,524.2
Total THMs	**5.0**	**4.6**	**-**	**-**
Haloacetic Acids				
Dibromoacetic Acid	1.3	1.3	1.0	552.2
Dichloroacetic Acid	<1.0	<1.0	1.0	552.2
Monobromoacetic Acid	<1.0	<1.0	1.0	552.2
Monochloroacetic Acid	<2.0	<2.0	2.0	552.2
Total HAAs	**1.3**	**1.3**	-	-

3.3.1.4 Backwash Characteristics

Filter composite backwash water quality from field analyses is presented in Table 3.20. Samples were diluted with distilled water to obtain readings that were in the range of the field tests (2.2 mg/L iron, and 0.8 mg/L) manganese. Data from laboratory analyses are included in Tables 3.21 and 3.22.

Table 3.20: Well 17A - Backwash Water Quality from Field Analyses

Trial	Filter	Composite Backwash	
		Fe (mg/L)	Mn (mg/L)
9	A	2.500	4.275
	B	1.700	3.225
	C	4.600	10.350
	D	3.050	7.725

Table 3.21: Trial 6 Composite Backwash Water, Laboratory Results

Filter	Total Iron (mg/L)	Total Manganese (mg/L)	TSS (mg/L)	Chlorine Residual (mg/L)
A	7.10	3.32	32.0	0.36
C	8.20	3.74	78.0	<0.02

Table 3.22: Trial 6 Backwash Settled Supernatant, Laboratory Results

Filter	Total Iron (mg/L)	Total Manganese (mg/L)	TSS (mg/L)	Chlorine Residual (mg/L)
A	0.173	0.099	<5.0	<0.02
C	0.080	0.137	<5.0	<0.02

The iron concentration in the combined backwash water was 7 to 8 mg/L as reported by the certified laboratory. The combined back wash manganese concentration was near 3.5 mg/L. This is consistent with ratio of iron to manganese in the raw water. These concentrations are used in the next section to evaluate mass balance and contaminant recovery in the backwash. The iron and manganese concentrations in the supernatant after 48 hours of settling were similar to raw water concentrations and, therefore, may be suitable for recycling.

3.3.1.5 Mass Balance

The backwash lab analyses were used to compare the mass of iron and manganese collected on the filter media during filtration with the mass of iron and manganese removed during a backwash. Table 3.23 summarizes mass recovery data for the filters. This data includes the following columns:

- "Trial" is the Trial number.
- "Influent Concentrations (mg/L)" are the average iron and manganese concentration in the influent water, including manganese from the potassium permanganate added.
- "Volume (gal)" is the total water that was treated during the filter trial.
- "Backwash Fe, and Mn (mg/L)" is the concentration of iron and manganese present in the composite backwash sample, analyzed by diluting the CBW with distilled water and analyzing using field methods.
- "Mass Removed by Filtration(mg)" is the mass of iron and manganese that is calculated to have been trapped on the filter, calculated as follows:

$$Mass\ Accumlated\ (mg) = \left(Volume_{Filtered} \times 3.785\frac{L}{gal}\right)\ x\ \ Conc._{POX} -\ \ Conc_{Eff}$$

Where:

$Conc._{POX}$= Mn or Fe present post chemical injection and prior to filtration.
$Conc._{Eff}$= The concentration of iron or manganese present post filtration.
$Volume_{Filtered}$ = Total volume of water filtered during the trial.

1. "Mass Recovered in Backwash (mg)" is the mass of iron and manganese that is calculated to have been removed from the filter during the backwash, calculated as follows:

$$Mass\ Recovered\ in\ Backwash = \left(Volume_{BW} \times 3.785\frac{L}{gal}\right)\ x\ Composite_{BW}$$

Where:

$Composite_{BW}$= Contaminant concentration present in the 24 gall backwash sample.
$Volume_{BW}$ = Volume of water used for backwash (gal) = 24 gallons for all P/C Trials

2. Recovery (%)" is the percent of iron or manganese recovered from the filter through backwash. The *Mass Recovered in Backwash* was calculated as the product of the *Backwash Concentration* and the *Backwash Volume*. The *Mass Recovery* for iron and manganese was calculated as the ratio of the backwash mass to the filter service mass:

$$Mass\ Recovery = \left(\frac{M_{BW}}{M_{FS}}\right)\ x\ 100\%$$

Where: M_{BW} = Contaminant mass recovered in backwash (mg)
M_{FS} = Contaminant mass accumulated during filter service (mg)

Table 3.23: Mass Balance Calculations for Backwash Water

Trial #	Influent Concentrations		Backwash Water			Mass Retained on Filter		Mass Contained in Backwash		Recovery	
	Fe (mg/L)	Mn (mg/L)	Volume (ga)	Fe (mg/L)	Mn (mg/L)	Fe (mg)	Mn (mg)	Fe (mg)	Mn (mg)	Fe (%)	Mn (%)
Trial 6, Filter A	0.08	0.09	24	7.1	3.32	1.053	1.185	0.645	0.302	61%	25%
Trial 6, Filter C	0.08	0.09	24	8.2	3.74	1.076	1.211	0.745	0.340	69%	28%

Contaminant recovery was between 60 and 70% for iron and near 25% for manganese. Iron recoveries are typically higher for iron than manganese. Manganese recoveries have also been observed to be lower when using sodium hypochlorite for oxidation when compared to potassium permanganate on other pilot studies. It is not known if iron and manganese recovery during backwash would increase over time as the media ripens and acclimates to the water source.

3.3.2 Performance of Advanced Oxidation Process (AOP) for 1,4-Dioxane Removal

Three different AOP treatment scenarios were piloted during the Barnstable pilot study for removal of 1,4-Dioxane.

- Post Iron and Manganese Removal. AOP with UV was evaluated after pilot scale removal of iron and manganese by pressure filtration. The limited amount of filter effluent from the iron and manganese removal pilot was not sufficient to feed the specified Trojan UV system and, therefore, a smaller generic UV system was utilized.
- Sequestering of Iron and Manganese. An 8-week extended run evaluated the Trojan UV system after chemical sequestration of iron and manganese.
    - Dose Scenario 1. The initial 5 weeks of the extended run were operated with a dose of 5 ppm hydrogen peroxide and a ballast power level of 100%.
    - Dose Scenario 2. Due the high UVT (>99%) of the pilot influent the dose was reduced to 1 ppm hydrogen peroxide and a ballast power level of 60%.

Table 3.24 details the operating conditions for the different treatment scenarios. Table 3.25 summarizes the UV AOP field and laboratory water quality data for the duration of the pilot study.

Table 3.24: Advanced Oxidation Process with UV - Operating Conditions

Start	Finish	Description	UV System	Flow Rate (gpm)	Influent UVT (%)	Ballast Power Level (%)	H2O2 Dose (ppm)	Sequestering Agent Dose (ppm)
7/24/2017	8/04/2017	Post Iron and Manganese Removal	Conventional	4.0		100	5.0	0.0
8/07/2017	9/06/2017	Extended 8-Week Run Iron and Manganese Sequestered	Trojan	20.0	99.75 ±0.45 (8,266)	100	5.0	1.75
9/06/2017	9/29/2017			20.0	99.66 ±0.33 (8,266)	60	1.0	1.75

Note: UVT was analyzed by the Optiview™ online UVT measurement system provided with the Trojan UV system and was not available for the generic UV system.

Table 3.25: Advanced Oxidation Process with UV Effluent – Field and Lab Water Quality Data

Date	Upstream Fe/Mn Treatment	UV Treatment	H2O2 Concentration by Field Analyses (ppm)		Iron (mg/L)	Manganese (mg/L)	1,4-Dioxane (µg/L)	PFOS (ng/L)	PFOA (ng/L)	Bromate (µg/L)
			Pre-UV	Post-UV						
8/3/2017	Fe/Mn Removal By Pressure Filtration	Conventional UV System	No Data	No Data			0.691	91.0	17.5	
8/4/2017			No Data	No Data			0.633	68.9	16.7	
8/7/2017	Sequestration of Iron and Manganese By Chemical Pretreatment with Carus 1205	Trojan UV Extended Run Week 1	No Data	No Data	0.081	0.053	ND (<0.144)	89.5	ND (<1.85)	ND (<1.0)
8/11/2017			5.0	1.5	0.057	0.050	ND (<0.144)	99.3	21.6	ND (<1.0)
8/18/2017		Trojan UV Extended Run Week 2	5.0	1.0	0.072	0.051	ND (<0.144)	87.9	22.0	ND (<1.0)
8/23/2017		Trojan UV Extended Run Week 3	3.0	2.0	0.082	0.053	ND (<0.147)	85.7	20.7	ND (<1.0)
8/30/2017		Trojan UV Extended Run Week 4	2.5	2.5	0.086	0.051	ND (<0.147)	73.0	20.4	ND (<1.0)
9/6/2017		Trojan UV Extended Run Week 5	5.0	2.0	0.085	0.041	ND (<0.144)			ND (<1.0)
9/13/2017		Trojan UV Extended Run Week 6	1.0	0.9	0.120	0.048	ND (<0.147)			ND (<1.0)
9/20/2017		Trojan UV Extended Run Week 7	1.0	0.8	0.090	0.050	ND (<0.147)			ND (<1.0)
9/27/2017		Trojan UV Extended Run Week 8	1.0	0.5	0.092	0.049	ND (<0.144)			

3.3.3 Performance of GAC Contactors for PFOS/PFOA Removal

GAC contactors for treatment of PFOS/PFOA were operated downstream of the advanced oxidation process with UV.

3.3.3.1 Summary Tables for GAC Contactor Performance

Table 3.26 summarizes the operating conditions for the GAC contactors during the pilot study. Contactors E and F were operated under identical conditions.

Table 3.26: GAC Contactor Operating Conditions

Start Date	End Date	Duration (days)	Upstream Processes	Nominal Flow Rate (gpm)	EBCT (min)	Cumulative Flow (gallons)	Average Influent Concentration		Total Contaminant Mass	
							PFOS (ng/L)	PFOA (ng/L)	PFOS (µg)	PFOA (µg)
7/25/2017	8/4/2017	11	Fe/Mn Removal UV AOP w/ Generic UV	0.4	11	5,760	77.6	17.3	1,692	377
8/7/2017	9/29/2017	53	Fe/Mn Sequestration UV AOP w/ Trojan UV	0.4	11	30,528			8,967	1,999
Total		64							10,659	2,376

3.3.3.2 GAC Contactor Effluent Water Quality

Table 3.27 summarizes the lab results for GAC contactor water quality analyses.

Table 3.27: GAC Contactor Effluent – Lab Water Quality Data

Date	Upstream Treatment		Iron (mg/L)		Manganese (mg/L)		1,4-Dioxane (µg/L)		PFOS (ng/L)		PFOA (ng/L)		Bromate (µg/L)	
	Fe/Mn	1,4-Dioxane	GAC Filter E	GAC Filter F	GAC Filter E	GAC Filter F	GAC Filter E	GAC Filter F	GAC Filter E	GAC Filter F	GAC Filter E	GAC Filter F	GAC Filter E	GAC Filter F
8/3/2017	Fe/Mn Removal By Pressure Filtration	Conventional UV System					0.299	0.279	ND (<1.78)	ND (<1.78)	ND (<1.78)	ND (<1.78)		
8/4/2017							0.316	0.309	ND (<1.85)	ND (<1.92)	ND (<1.85)	ND (<1.92)		
8/7/2017	Sequestration of Iron and Manganese By Chemical Pretreatment with Carus 1205	Trojan UV Extended Run Week 1	ND (<0.050)	ND (<0.050)	0.060	0.058	0.214	0.238	ND (<1.78)	ND (<1.85)	ND (<1.78)	ND (<1.85)	ND (<1.0)	ND (<1.0)
8/11/2017			ND (<0.050)	ND (<0.050)	0.052	0.053	0.411	0.416	ND (<1.72)	ND (<1.67)	ND (<1.72)	ND (<1.67)	ND (<1.0)	ND (<1.0)
8/18/2017		Trojan UV Extended Run Week 2	ND (<0.050)	ND (<0.050)	0.052	0.051	0.204	0.209	ND (<1.72)	ND (<1.78)	ND (<1.72)	ND (<1.78)	ND (<1.0)	ND (<1.0)
8/23/2017		Trojan UV Extended Run Week 3	ND (<0.050)	ND (<0.050)	0.052	0.051	<0.147	<0.144	ND (<1.72)	ND (<1.72)	ND (<1.72)	ND (<1.72)	ND (<1.0)	ND (<1.0)
8/30/2017		Trojan UV Extended Run Week 4	0.148	ND (<0.050)	0.087	0.050	<0.147	<0.147	ND (<1.72)	ND (<1.78)	ND (<1.72)	ND (<1.78)	ND (<1.0)	ND (<1.0)
9/6/2017		Trojan UV Extended Run Week 5	ND (<0.050)	ND (<0.050)	0.058	0.048			ND (<1.72)	ND (<1.67)	ND (<1.72)	ND (<1.67)	ND (<1.0)	ND (<1.0)
9/13/2017		Trojan UV Extended Run Week 6	ND (<0.050)	ND (<0.050)	0.042	0.041	<0.147	<0.144	ND (<1.72)	ND (<1.72)	ND (<1.72)	ND (<1.72)	ND (<1.0)	ND (<1.0)
9/20/2017		Trojan UV Extended Run Week 7	ND (<0.050)	ND (<0.050)	0.045	0.046	<0.144	<0.144	ND (<1.72)	ND (<1.72)	ND (<1.72)	ND (<1.72)		
9/27/2017		Trojan UV Extended Run Week 8	ND (<0.050)	ND (<0.050)	0.044	0.045	<0.147	<0.144	ND (<1.78)	ND (<1.72)	ND (<1.78)	ND (<1.72)		

Note: GAC contactor effluent for both contactors was also submitted for TOC analyses on 8/4/2017. Results for both samples were reported as <0.500 mg/L.

4 DATA ANALYSIS AND DISCUSSION

4.1 RAW WATER

4.1.1 Was Raw Water Representative of Historic Data?

This section compares raw water data generated during the pilot study with historical data to determine if the water utilized during the pilot study was representative of typical concentrations.

Table 4.01 summarizes the median iron and manganese concentrations for field results, lab results and historical levels. Figures 4.01 and 4.02 are box plots of the raw iron and manganese data. The regulatory limit and historical data reference are plotted on the figures for comparison.

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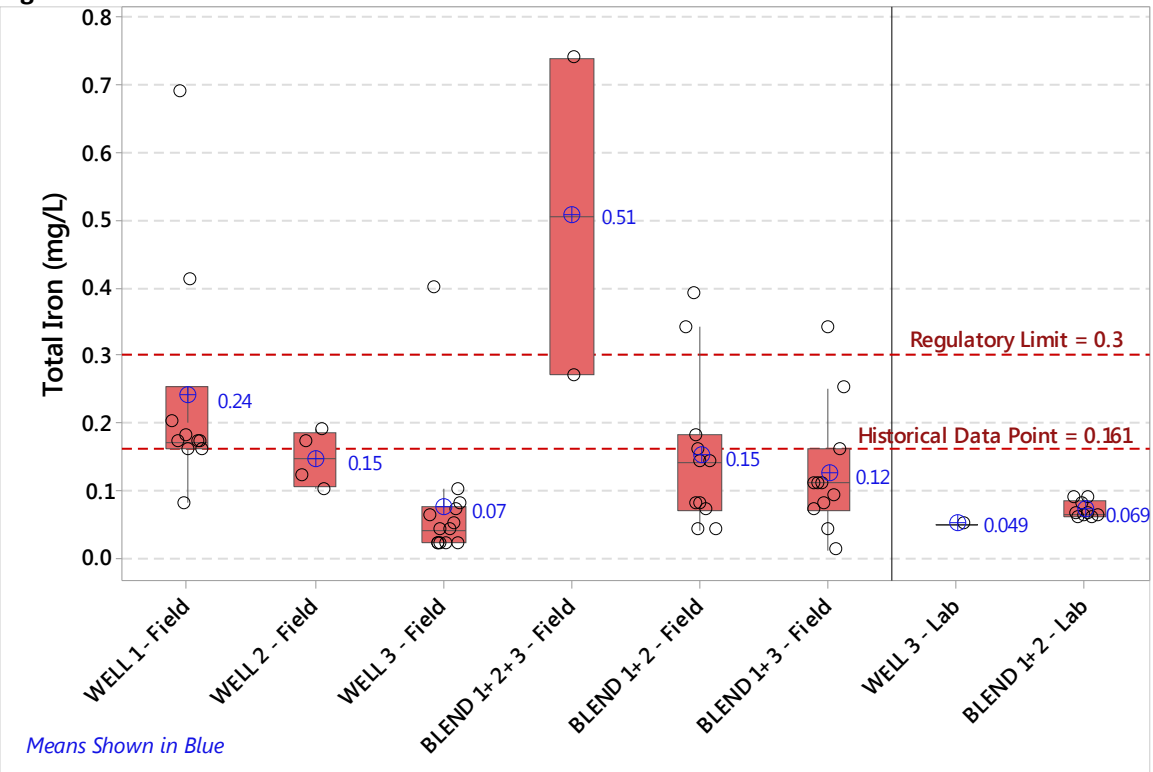
Table 4.01: Comparison of Iron Manganese Concentrations with Historical Levels

Parameter	Median (min-max) [sample count]								
	Field Results (from Table 3.02)						**Lab Results** (from Table 3.03)		**Historical Average** (from Protocol and Table 1.01)
	Well 1	Well 2	Well 3	Well 1 – 2 – 3 Blend	Well 1 – 3 Blend	Well 1 – 2 Blend	Well 3	Well 1 – 2 Blend	100-FT Tap Well Combination Unkown
Iron, total (mg/L)	**0.17** (0.08-0.69) [10]	**0.15** (0.10-0.19) [4]	**0.04** (0.02-0.04) [13]	**0.51** (0.27-0.74) [2]	**0.11** (0.01-0.34) [11]	**0.14** (0.04-0.39) [11]	**<0.050**	**0.067** (0.057-0.096) [12]	**0.161**
Manganese, total (mg/L)	**0.086** (0.041-0.135) [10]	**0.046** (0.025-0.046) [4]	**0.105** (0.088-0.141) [13]	**0.154** (0.150-0.157) [2]	**0.092** (0.026-0.108) [11]	**0.045** (0.032-0.125) [11]	**0.1154**	**0.050** (0.040-0.053) [12]	**0.037** (0.026-0.066) [12]

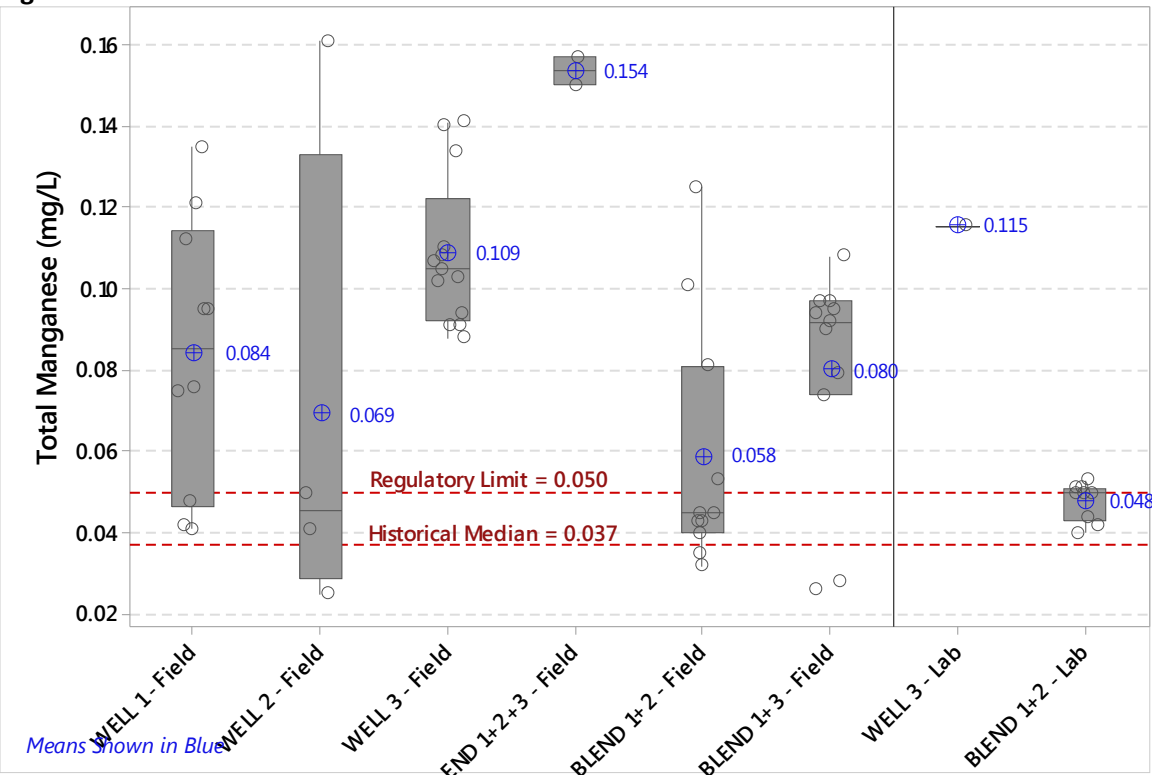
Figure 4.01: Maher Wells Raw Water Fe Data



The historical iron data was from a single data point collected from the 100-foot sample tap during July 2015 (two other samples were reported to be below the laboratory detection limit of 0.10 mg/L). It is not known what well or wells were represented in this sample. The historical reference line was higher than three of the pilot study data groupings. Three of the pilot data grouping intersected the historical reference line. All data from one data group (Blend 1+2+3 – Field) was higher than the historical reference line. The "Blend 1+2+3 – Field" group represented two data collected soon after startup of Wells 1 and 2. Water quality had not stabilized and had atypically high iron concentrations.

The pilot study data appeared to be generally similar to the historical data point of 0.161 mg/L. The two atypically high data points for Blend 1+2+3 were the only grouping which exceeded the regulatory limit of 0.3 mg/L.

Figure 4.02: Maher Wells Raw Water Mn Data



The historical manganese data consisted of three annual samples collected from the 100-foot sample tap representing 2014, 2015 and 2016. It is not known what well or wells were represented in these three samples. The historical reference line was lower than all data from six of the pilot study data groupings. Two of the pilot data grouping intersected the historical reference line. None of the data groups were entirely lower than the historical reference line. The Blend 1+2+3 – Field group represented two data collected soon after startup of Wells 1 and 2 before the water quality had stabilized and had atypically high manganese concentrations.

The pilot study data appeared to be generally higher than the historical data median of 0.037 mg/L. The median manganese concentrations for seven of the eight data groups exceeded the regulatory limit of 0.050 mg/L.

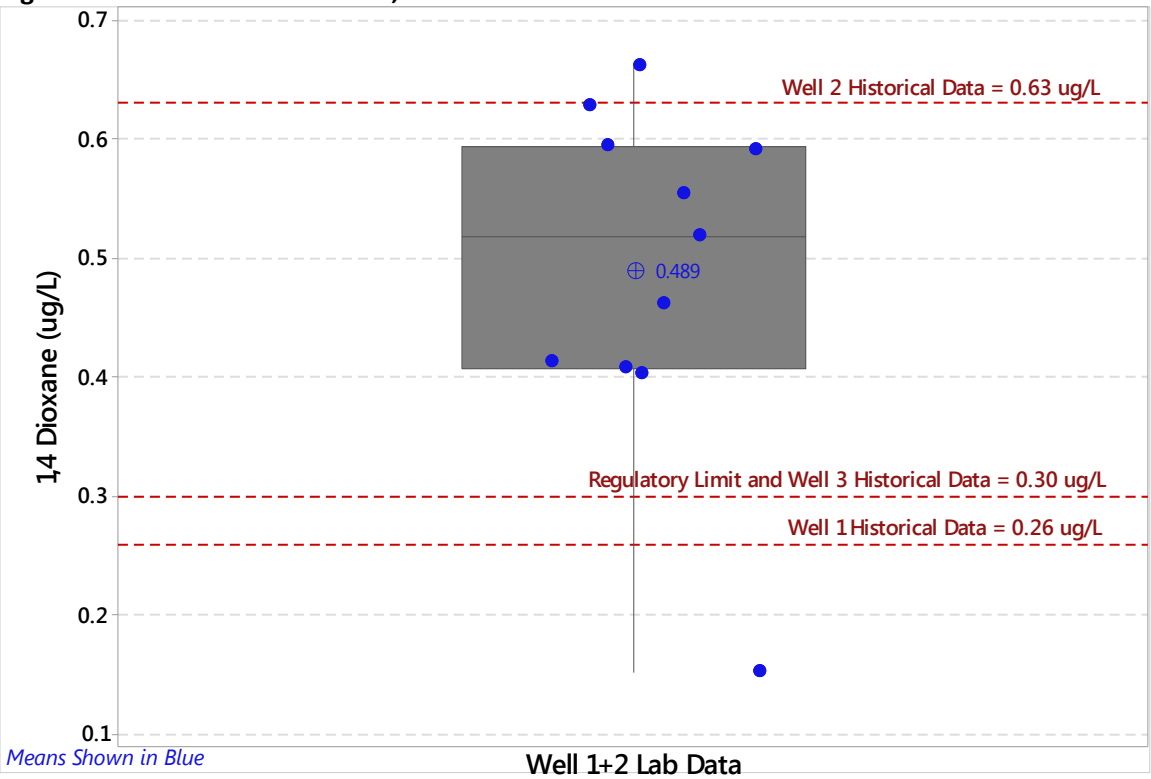
Table 4.02 summarizes the median 1,4-Dioxane and combined PFOS/PFOA concentrations for lab results and historical levels. Figures 4.03 and 4.04 are box plots of the raw 1,4-Dioxane and combined PFOS/PFOA data. The regulatory limit and historical data reference are also plotted on these figures for comparison

Table 4.02: Comparison of 1,4-Dioxane, PFOS, PFOA Concentrations with Historical Levels

Parameter	Median (min-max) [sample count]				
	Lab Results (from Table 3.03)		**Historical Average** (from Protocol and Table 1.01)		
	Well 3	Well 1+2	Well 1	Well 2	Well 3
1,4-Dioxane (µg/L)		**0.518** (0.152-0.661) [11]	**0.26** [2]	**0.63** (0.44-0.82) [2]	**0.30** (0.24-0.36) [2]
PFOS (ng/L)	**83.2**	**77.1** (65.4-93.4) [11]	**110**	**32**	**73**
PFOA (ng/L)	**18.6**	**18.2** (1.84-21.3) [11]	**22**	**5.3**	**11**
Total PFCs (ng/L)	**101.8**	**93.2** (82.4-114.7) [11]	**132**	**37.3**	**84**

Figure 4.03 is a box plot of all raw 1,4-Dioxane data generated during the pilot study. Raw water from each of the three wells was analyzed for 1,4-Dioxane during 2015 and 2016. The average of the two results for each well is shown on the figure for reference. The Well 3 historical average concentration is the same as the regulatory limit of 0.3 µg/L. All raw 1,4-Dioxane data from the pilot study are shown in Figure 4.03 as solid blue circles (11 sample events using Wells 1 and 2), and are summarized with the gray box.

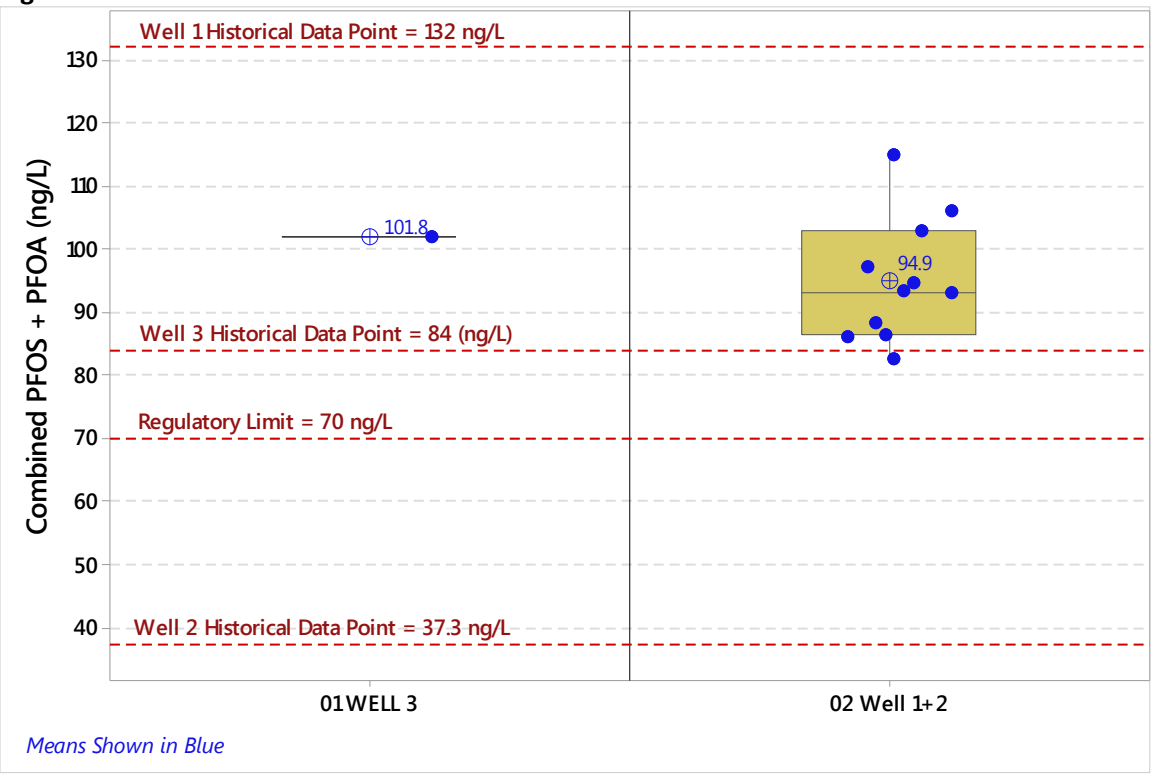
Figure 4.03: Maher Wells Raw 1,4-Dioxane Data



The box plot shows that the Well 1+2 raw 1,4-Dioxane concentrations were primarily between the historical averages for the two blended wells and therefore representative when compared to historical data.

Figure 4.04 is a box plot of all raw combined PFOS/PFOA generated during the pilot study. Raw water from each of the three wells was analyzed for PFOS/PFOA during May 2016. The combined PFOS + PFOA result is shown on Figure 4.04 as the historical reference line. During the pilot study an initial raw sample was collected during operation with Well 3. All subsequent pilot study data was collected during the extended run which operated with the Well 1+2 blend.

Figure 4.04: Maher Wells Raw Combined PFOS + PFOA Data



The pilot study lab result for Well 3 was 101.8 ng/L which was similar to but slightly greater than the historical average of 84 ng/L.

The box plot of the Well 1+2 PFOS/PFOA data shows that the pilot study data is entirely in between the two historical reference lines for the blended wells. The pilot study PFOS/PFOA data appears to be representative of historical data.

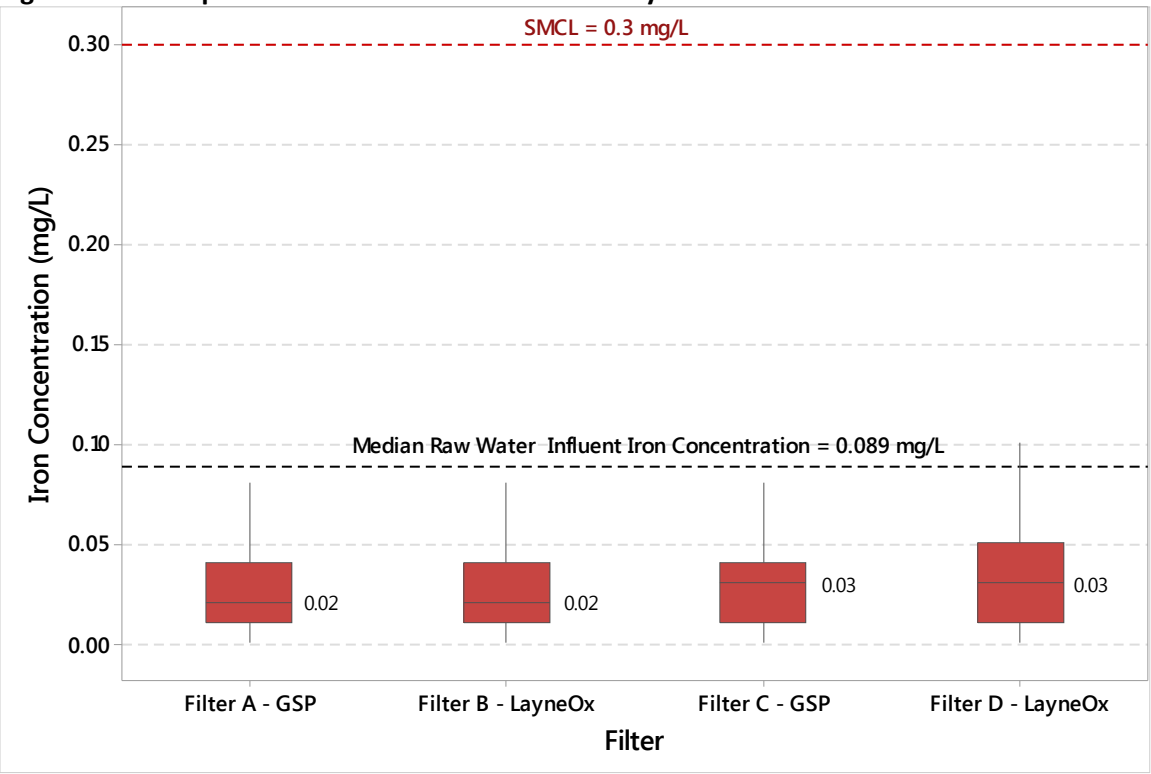
4.2 PRESSURE FILTRATION FOR IRON AND MANGANESE REMOVAL

Iron and manganese removal was evaluated by comparing the filter effluent data to the treatment goals established in the pilot study protocol. The data was evaluated by filter, media type and filter loading rate.

4.2.1 Was Pressure Filtration Effective for Iron Removal?

Tables 3.13 to 3.16, presented in Section 3.0 Results, confirm that the median effluent iron concentrations for all filter trials were below the regulatory limit of 0.3 mg/L. Figure 4.05 is a boxplot of the combined filter effluent data for each filter for the duration of the pilot study.

Figure 4.05: Boxplot of Effluent Iron Concentration by Filter

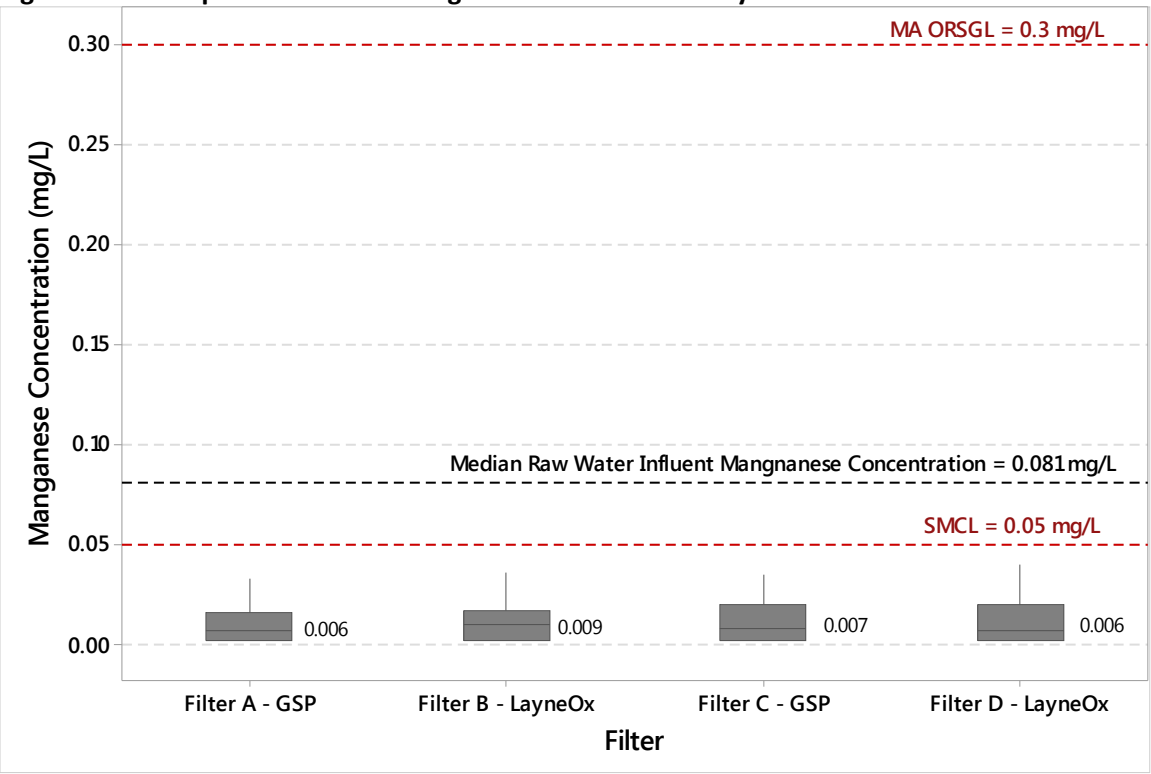


The box plot shows that raw iron concentrations were reduced to a median concentration below 0.05 mg/L for all four filters. All effluent iron concentrations were well below the regulatory limit of 0.3 mg/L. The median raw iron concentration of 0.089 mg/L is also plotted on the figure for reference and is also below the regulatory limit.

4.2.2 Was Pressure Filtration Effective for Manganese Removal?

Tables 3.13 to 3.16, presented in Section 3.0 Results, confirm that the median effluent manganese concentrations for all filter trials were below the regulatory limit of 0.05 mg/L. Figure 4.06 is a boxplot of the combined filter effluent data for each filter for the duration of the pilot study.

Figure 4.06: Boxplot of Effluent Manganese Concentration by Filter



The box plot shows that raw manganese concentrations were reduced to a median concentration below 0.01 mg/L for all four filters. The median effluent manganese concentrations were below the regulatory limit of 0.05 mg/L. The median raw manganese concentration of 0.081 mg/L is also plotted on the figure for reference and exceeded the regulatory limit.

4.2.3 Did Media Type Impact Iron and Manganese Removal?

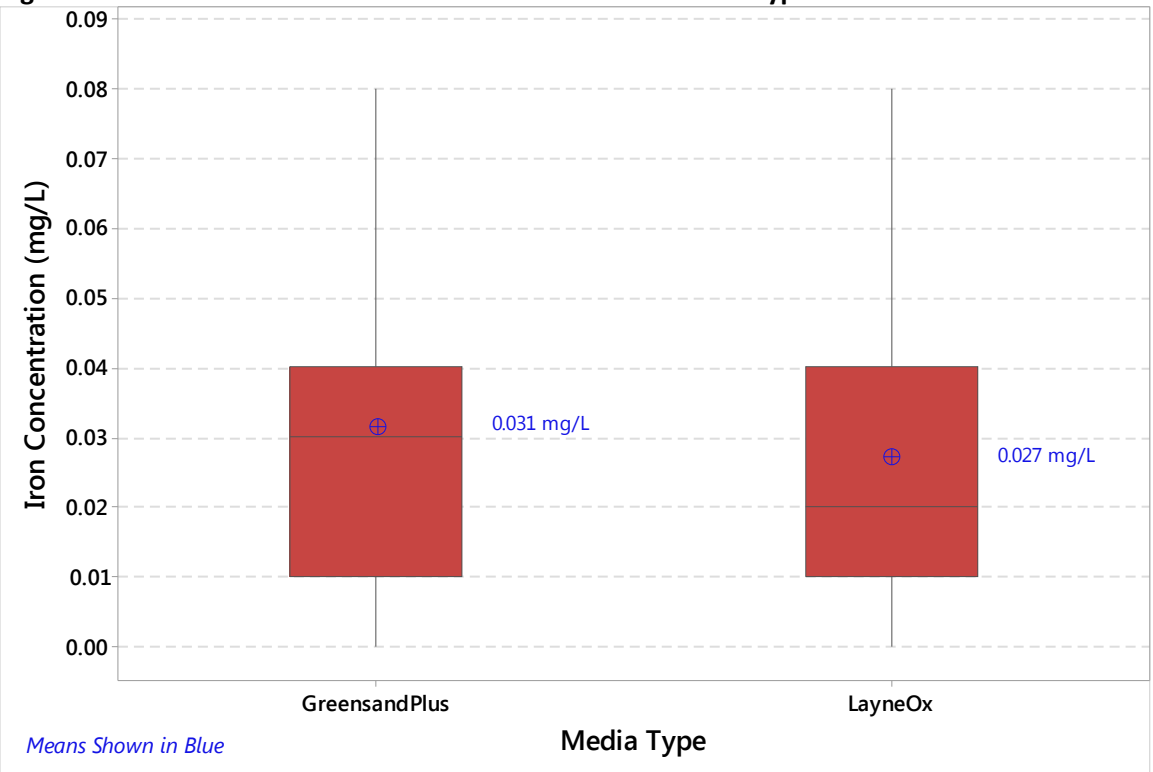
Table 4.03 shows the results of a one-way ANOVA of effluent iron data vs. media type. The ANOVA compares effluent iron data sets from the filters containing GreensandPlus media to the filters containing LayneOx media. The confidence interval was 95%; the level of significance was 5% (α = 0.05). This ANOVA is provided as an initial example and any future ANOVAs will not be shown in the report.

Table 4.03: Comparison of Effluent Total Fe vs Media Type

```
Null hypothesis          All means are equal
Alternative hypothesis   At least one mean is different
Significance level       α = 0.05
Rows unused              128

Analysis of Variance

Source       DF    Adj SS    Adj MS  F-Value  P-Value
Media Type    1  0.000978  0.000978     1.54    0.215
Error       196  0.124093  0.000633
Total       197  0.125071

        S   R-sq  R-sq(adj)  R-sq(pred)
0.0251620  0.78%      0.28%       0.00%

Means

Media Type      N     Mean    StDev         95% CI
GreensandPlus  99  0.03141  0.02688  (0.02643, 0.03640)
LayneOx        99  0.02697  0.02332  (0.02198, 0.03196)

Pooled StDev = 0.0251620
```

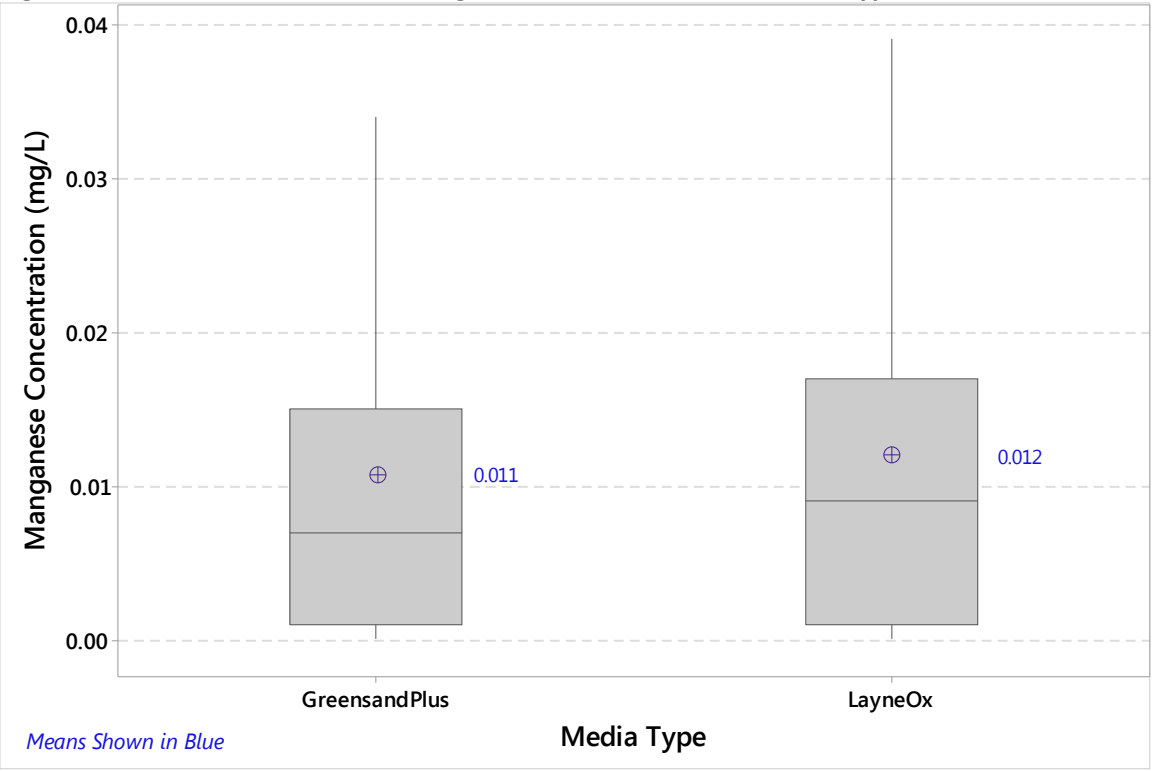
The probability value (P) was 0.215. Since P was greater than alpha (0.000 < 0.05) the null hypothesis was accepted and the means of the two data sets were not considered statistically different. Figure 4.07 is a box plot of the effluent iron concentrations compared by media type. The box plot shows that iron removal by GreensandPlus and LayneOx was similarly effective based on comparison of effluent iron data.

Figure 4.07: Box Plot of Effluent Iron Concentration vs Media Type



A one-way ANOVA was also performed on the effluent manganese data. The ANOVA compared effluent manganese data sets from the filters containing GreensandPlus media to the filters containing LayneOx media. The confidence interval was 95%; the level of significance was 5% ($\alpha = 0.05$). The probability value (P) was 0.509. Since P was greater than alpha ($0.000 < 0.05$) the null hypothesis was accepted and the means of the two data sets were not considered statistically different. Figure 4.08 is a box plot of the effluent manganese concentrations compared by media type. The box plot shows that manganese removal by GreensandPlus and LayneOx was similarly effective based on comparison of effluent manganese data.

Figure 4.08: Box Plot of Effluent Manganese Concentration vs Media Type



4.2.4 What are Expected Filter Run Times?

Filter run times were limited by the pilot schedule and not terminal headloss or contaminant breakthrough during the pilot study. Filter run times of over 70 hours were completed while operating at target loading rates of 4 and 6 gpm/sf before being shut down for scheduled changes. It is unknown whether headloss or breakthrough would be the limiting factor if the filters were operated beyond 70 hours. Based on the raw iron and manganese concentrations, and oxidation with sodium hypochlorite, filter run times in excess of 24 hours should be expected for the piloted filter surface loading rates of 4 to 6.4 gpm/sf.

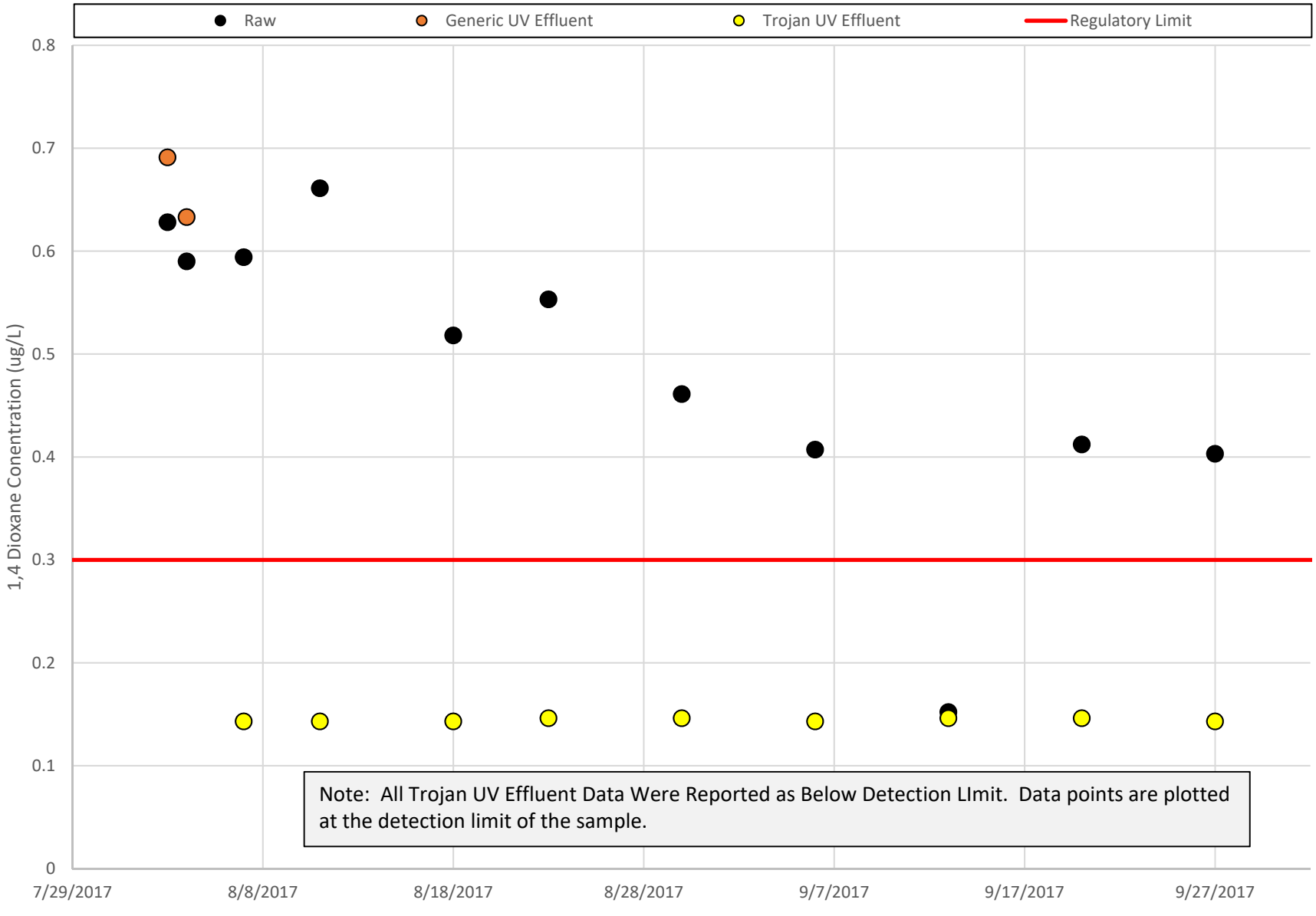
4.3 ADVANCED OXIDATION PROCESS FOR 1,4-DIOXANE REMOVAL

4.3.1 Was AOP Effective for 1,4-Dioxane Removal?

Figure 4.09 plots the raw and UV effluent 1,4-Dioxane data for the pilot study. The figure shows that the raw 1,4-Dioxane concentration was in the 0.4 to 0.7 µg/L range. The smaller generic UV system utilized downstream of the iron and manganese pilot system was not effective in removing 1,4-Dioxane as shown by the two red data markers. The generic UV system was utilized because there was insufficient water produced by the iron and manganese pilot system to supply the larger Trojan UV system. It is likely that the generic UV system did not have the lamp power necessary for the advanced oxidation process.

The Trojan UV system was started up on August 7, 2017 for an extended 8-week run. The Trojan UV system was effective for destruction of 1,4-Dioxane by AOP as all effluent samples were reported as below detection limit for the entirety of the extended run. These data points were plotted on the figure in yellow at the lab's minimum detection limit.

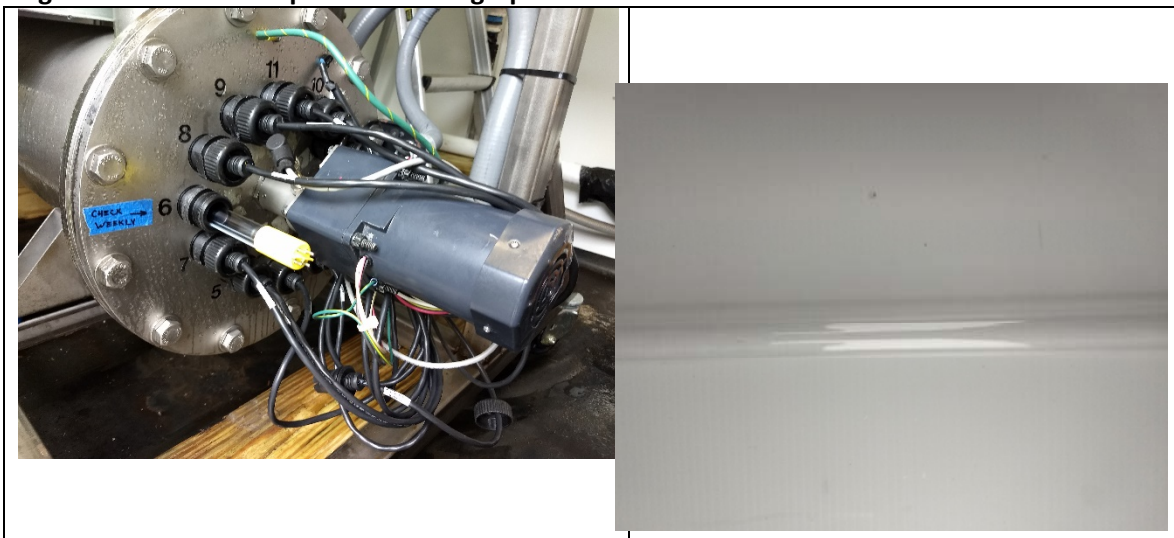
Figure 4.09: Raw and Treated 1,4 Dioxane Data



4.3.2 Were UV Lamp Sleeves Fouled During the 8-Week Extended Run?

Each week during the pilot study the UV system was shut down and one of the twelve lamp sleeves was removed for visual inspection of potential fouling. The same sleeve was removed each week and photographed. There was no visual indication of fouling throughout the study. Figure 4.10 shows lamp being removed prior to sleeve removal and the subsequent final sleeve photograph from Week 8.

Figure 4.10: Final Lamp Sleeve Photograph – Week 8



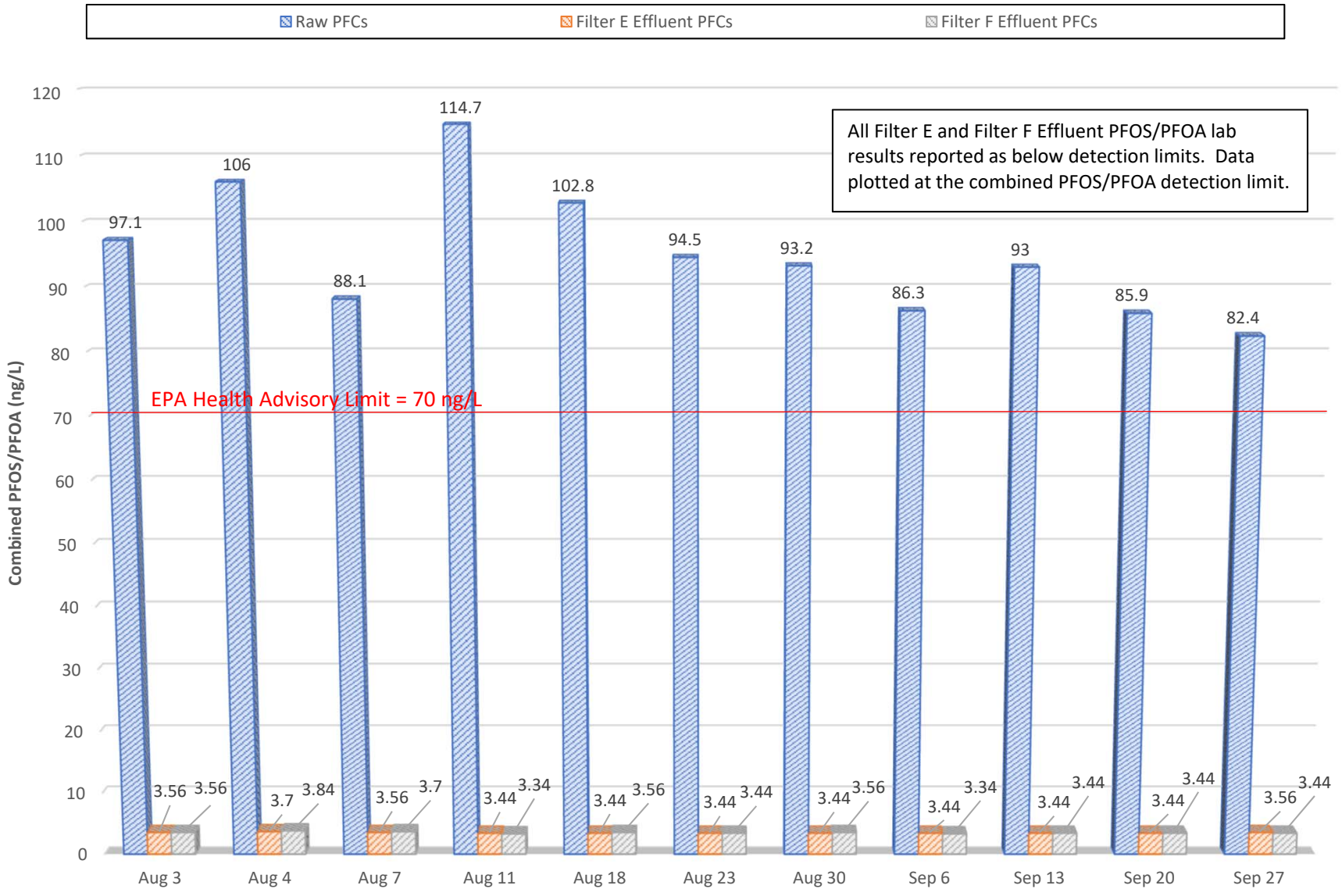
Additionally, a lamp sleeve was removed at the end of piloting and shipped to Trojan Technologies for UVT analysis and comparison to a new sleeve. As of October 26, 2017, the result is still pending.

4.4 GAC CONTACTORS FOR PFOS/PFOA REMOVAL

4.4.1 Were GAC Contactors Effective for PFOS/PFOA Removal?

Figure 4.11 plots the combined PFOS/PFOA lab results for raw water and effluent from GAC Contactors E and F. The figure shows that the raw PFOS/PFOA concentration was in the 80 to 120 ng/L range. The GAC contactors were effective for removal of PFOS/PFOA as all contactor effluent samples were reported as below detection limits. The contactor effluent data points were plotted at the detection limit on the figure.

FIGURE 4.11: RAW AND TREATED PFOS/PFOA DATA



4.4.2 Hydraulic Performance of GAC Contactors

For each contactor online data were logged every 5 minutes. The data logger recorded flow rate, differential pressure and effluent turbidity. The online data logger was not functioning prior to the start of the extended run on August 7.

Flow rate during the 8-week extended run was controlled by a PLC based PID control system. A set point of 0.4 gpm was established to maintain the specified EBCT of 11 minutes. Flow rate fluctuated some during the course of the extended run such that the EBCT actually ranged from 9 to 13 minutes.

There was some headloss development over the course of the extended run. Headloss would increase by 2 to 3 psi per week. The system was shutdown weekly for UV lamp inspection. Upon restart the headloss would return to the initial headloss conditions. It appears that the headloss development was due to media compaction over time and that the filter media relaxed during the weekly shutdown. There was evidence of iron removal based on water quality data and some visual accumulation at the surface of the media (Figure 4.12). However, the differential pressure never approached 10 psi, when a backwash would normally be initiated, and the contactors were never backwashed.

Contactor effluent turbidity remained below 0.1 NTU throughout the 8-week extended run.

Figure 4.12: Iron Accumulation on the GAC Contactor Media Surface

4.4.3 Were GAC Contactors Impacted by 1,4-Dioxane?

This section reviews influent and effluent 1,4-Dioxane concentrations for the GAC contactors during the pilot study. During operation of the low-rate generic UV system, effective destruction of 1,4-Dioxane was not achieved and the GAC contactors were exposed to the raw concentration. Table 4.04 summarizes the 1,4-Dioxane concentrations in relation to the GAC contactors.

Table 4.04: 1,4-Dioxane Data Through the UV/GAC Train

Date	Description	UV System	1,4-Dioxane Concentration (µg/L)			
			Raw	UV Effluent	GAC Filter E	GAC Filter F
8/3/2017	Post Fe/Mn Removal	Generic	0.628	0.691	0.299	0.279
8/4/2017			0.590	0.633	0.316	0.309
8/7/2017	Extended Run Week 1	Trojan	0.594	ND (<0.147)	0.214	0.238
8/11/2017			0.661	ND (<0.147)	0.411	0.416
8/18/2017	Extended Run Week 2		0.518	ND (<0.147)	0.204	0.209
8/23/2017	Extended Run Week 3		0.553	ND (<0.147)	ND (<0.147)	ND (<0.144)
8/30/2017	Extended Run Week 4		0.461	ND (<0.147)	ND (<0.147)	ND (<0.147)
9/6/2017	Extended Run Week 5		0.407	ND (<0.144)	No Sample	No Sample
9/13/2017	Extended Run Week 6		0.152	ND (<0.147)	ND (<0.147)	ND (<0.144)
9/20/2017	Extended Run Week 7		0.412	ND (<0.147)	ND (<0.144)	ND (<0.144)
9/27/2017	Extended Run Week 8		0.403	ND (<0.144)	ND (<0.147)	ND (<0.144)

Table Comments

Generic UV system not effective for advanced oxidation and destruction of 1,4-Dioxane.

GAC filters removing some of the 1,4-Dioxane which was not destroyed by UV.

Trojan UV system effective for destruction of 1,4-Dioxane. All data below detection.

GAC filters desorbing 1,4-Dioxane collected during operation of generic UV.

1,4-Dioxane in GAC filters now depleted. Results below detection.

The table shows that during the initial period that 1,4-Dioxane destruction was not effective, the raw concentrations were reduced by approximately half in the GAC contactors. On August 7, 2017 the Trojan UV system was started up for the 8-week extended run and effectively destroyed 1,4-Dioxane for the duration. During this period of effective removal, the GAC contactors were now exposed to AOP water. The AOP water desorbed the 1,4-Dioxane which had previously accumulated in the GAC filters. This can be seen in the first three samples after startup of the Trojan system. 1,4-Dioxane concentrations are below detection after UV treatment but then have detectable levels after passing through the GAC filters (see green cells in table). After three weeks the accumulated 1,4-Dioxane had been desorbed and GAC contactor effluent reported non-detectable levels of 1,4-Dioxane for the remainder of the study.

5 CONCLUSIONS

RAW WATER

1. Field analyses of raw water iron were:
    a. Well 1 = 0.17 (0.08-0.69) [10]
    b. Well 2 = 0.15 (0.10-0.19) [4]
    c. Well 3 = 0.04 (0.02-0.04) [13]

    Average raw iron concentration in all three wells was below the SMCL of 0.3 mg/L for Fe. A historical data point of 0.161 mg/L was provided in the pilot study protocol, but it is unclear which well or wells were operating when the sample was collected. The historic data point was similar to the average Well 2 iron concentration from the pilot study.
2. Field analyses of raw water manganese averaged:
    a. Well 1 0.086 (0.041-0.135) [10]
    b. Well 2 = 0.046 (0.025-0.046) [4]
    c. Well 3 = 0.105 (0.088-0.141) [13]

    Raw manganese concentration in all three wells was close to or greater than the SMCL of 0.05 mg/L for Mn. A historical average of 2 data points provided in the pilot study protocol was 0.037 mg/L, but it is unclear which well or wells were operating. The average manganese concentration for all three wells during the pilot study exceeded the historic data provided.
3. Raw 1,4-Dioxane averaged 0.489 µg/L in 11 lab samples for the Well 1+2 blend. The Well 1+2 blend was used for the duration of the extended UV AOP run. The blended average was between the historic average for Well 1 (0.26 µg/L) and Well 2 (0.63 µg/L) provided in the pilot study protocol.
4. Combined raw PFOS/PFOA was 101.8 ng/L for a single lab sample at Well 3 and 94.8 ng/L in 11 lab samples for the Well 1+2 blend used during the extended UV AOP run. The Well 3 concentration was similar to, but slightly greater than, the historic data point of 84 ng/L. The Well 1+2 blend concentration appeared to be representative as the pilot data was between the historic data points for Well 1 (132 ng/L) and Well 2 (37.3 ng/L).

REMOVAL OF IRON AND MANGANESE BY ADSORPTION WITH PRESSURE FILTRATION

5. Raw iron was reduced from an average influent concentration of 0.089 to less than 0.05 mg/L by oxidation with NaOCl and pressure filtration with either GreensandPlus or LayneOx medias. Both influent and effluent iron were below the SMCL of 0.3 mg/L.
6. Raw manganese was reduced from an average influent concentration of 0.081 to less than 0.01 mg/L by oxidation with NaOCl and pressure filtration with either GreensandPlus or LayneOx medias.
7. Pressure filtration with both medias appeared to meet all other drinking water standards including secondary contaminants, and Disinfection By Products.
8. Filters were operated at filter surface loading rates between 4 gpm/sf and 6.4 gpm/sf.
9. It is unknown if filter runtime would be limited by headloss or breakthrough. Filters were operated up to 70 hours at loading rates of 4 and 6 gpm/sf and only shut down for scheduled changes.

10. Filter runtime should be expected to exceed 24 hours.

REMOVAL OF 1,4-Dioxane BY UV AOP

11. The UV Transmittance of UV pilot influent (raw water) was 99.7%.
12. Raw 1,4-Dioxane was effectively destroyed in all samples over the 8-week extended run conducted with the TrojanUVPhox™ 12AL30 UV-Oxidation System. Raw 1,4-Dioxane concentrations in excess of the 0.3 µg/L regulatory limit were reduced to below laboratory detection limits in all samples.
13. Effective advanced oxidation was achieved with two different peroxide (H_2O_2) dose/ballast power level (BPL) combinations; (1) 5 ppm H_2O_2 and 100% BPL and (2) 1 ppm H_2O_2 and 60% BPL. Both scenarios were operated at 20 gpm.
14. There was no visual evidence of UV lamp sleeve fouling based on weekly inspections. A sleeve was shipped to Trojan for UVT analysis. The results are pending and will be submitted separately upon receipt.
15. The smaller generic UV system was not capable of proper advanced oxidation and destruction of 1,4-Dioxane.

REMOVAL OF PFOS/PFOA BY ADSORPTION WITH GAC CONTACTORS

16. Raw PFOS and PFOA were effectively removed by adsorption with GAC contactors. The average combined raw PFOS and PFOA concentration of 95.5 ng/L was reduced to below lab detection limits in all samples collected during the pilot study.
17. The successful removal of PFOS/PFOA was achieved with 36 inches of GAC (Calgon Filtrasorb 400) media allowing 11 minutes of empty bed contact time.
18. The GAC contactors removed the raw iron which was likely oxidized to a removable particle during the UV AOP process. Raw manganese passed through the GAC contactors without removal.
19. When the GAC contactors were exposed to 1,4-Dioxane in the influent the GAC removed approximately half of the influent concentration.
20. A properly functioning UV AOP system upstream of the contactors produced water capable of stripping accumulated 1,4-Dioxane from the contactors.

APPENDIX A – Field Water Quality Data

Page	Row	Date and Time	SAMPLE LOCATION	Cl2 (f)	Cl2 (t)	Fe(t)	Fe (d)	Mn(t)	Mn (d)	pH	Temp
001		7/17/2017 14:30	04 MAHER WELL 3			0.080	0.030	0.141	0.126		
001		7/17/2017 14:30	04 MAHER WELL 3								
002		7/17/2017 14:30	05 POX A,B,C,D			0.050	0.030	0.025	0.050		
002		7/17/2017 14:30	05 POX A,B,C,D								
002		7/17/2017 14:30	21 FILTER A			0.040	0.030	0.013	0.036		
002		7/17/2017 14:30	21 FILTER A								
002		7/17/2017 14:30	22 FILTER B			0.040	0.040	0.015	0.068		
002		7/17/2017 14:30	22 FILTER B								
002		7/17/2017 14:30	23 FILTER C			0.040	0.030	0.024	0.064		
002		7/17/2017 14:30	23 FILTER C								
002		7/17/2017 14:30	24 FILTER D			0.040	0.020	0.014	0.034		
002		7/17/2017 14:30	24 FILTER D								
003		7/18/2017 11:45	04 MAHER WELL 3			0.060	0.050	0.107	0.109	5.44	
003		7/18/2017 11:45	04 MAHER WELL 3								
003		7/18/2017 11:45	05 POX A,B,C,D			0.050	0.020	0.085	0.067	6.63	
003		7/18/2017 11:45	05 POX A,B,C,D								
003		7/18/2017 11:45	21 FILTER A	1.28	1.44	0.030	0.020	0.000	0.014		
003		7/18/2017 11:45	21 FILTER A								
003		7/18/2017 11:45	22 FILTER B	1.57	1.47	0.030	0.040	0.002	0.015		
003		7/18/2017 11:45	22 FILTER B								
003		7/18/2017 11:45	23 FILTER C	0.88	1.33	0.030	0.030	0.000	0.019		
003		7/18/2017 11:45	23 FILTER C								
003		7/18/2017 11:45	24 FILTER D	1.21	1.43	0.050	0.020	0.000	0.017		
003		7/18/2017 11:45	24 FILTER D								
004		7/18/2017 13:15	04 MAHER WELL 3							5.55	
005	21	7/19/2017 10:00	05 POX A,B,C,D	6.25							
005	22	7/19/2017 10:00	21 FILTER A	4.78							
005	23	7/19/2017 10:00	22 FILTER B	5							
005	24	7/19/2017 10:00	23 FILTER C	51							
005	25	7/19/2017 10:00	24 FILTER D	3.78							

Page	Row	Date and Time	SAMPLE LOCATION	Cl2 (f)	Cl2 (t)	Fe(t)	Fe (d)	Mn(t)	Mn (d)	pH	Temp
006	04	7/19/2017 11:00	05 POX A,B,C,D	3.15							
006	05	7/19/2017 11:00	21 FILTER A	2.52							
006	06	7/19/2017 11:00	22 FILTER B	2.37							
006	07	7/19/2017 11:00	23 FILTER C	2.21							
006	08	7/19/2017 11:00	24 FILTER D	2.19							
007	04	7/19/2017 12:55	01 RAW BLEND			0.740		0.157		6.07	
007	04	7/19/2017 12:55	01 RAW BLEND							5.96	
007	01	7/19/2017 12:55	02 MAHER WELL 1			0.690		0.112		5.99	
007	01	7/19/2017 12:55	02 MAHER WELL 1							5.90	
007	02	7/19/2017 12:55	03 MAHER WELL 2			1.160		0.224		6.06	
007	02	7/19/2017 12:55	03 MAHER WELL 2							5.99	
007	03	7/19/2017 12:55	04 MAHER WELL 3			0.100		0.088		5.26	
007	03	7/19/2017 12:55	04 MAHER WELL 3							5.65	
007	06	7/19/2017 13:15	05 POX A,B,C,D	1.44	0.73	0.350	0.290	0.107	0.102	7.05	
007	06	7/19/2017 13:15	05 POX A,B,C,D							7.19	
007	07	7/19/2017 13:15	21 FILTER A	1.36	1.03	0.110		0.015		6.90	
007	07	7/19/2017 13:15	21 FILTER A							7.07	
007	08	7/19/2017 13:15	22 FILTER B	1.23	0.98	0.060		0.028		6.96	
007	08	7/19/2017 13:15	22 FILTER B							7.11	
007	09	7/19/2017 13:15	23 FILTER C	1.1	1.23	0.120		0.032		7.04	
007	09	7/19/2017 13:15	23 FILTER C							7.17	
007	10	7/19/2017 13:15	24 FILTER D	1.28	1.11	0.050		0.025		7.03	
007	10	7/19/2017 13:15	24 FILTER D							7.17	
007	12	7/19/2017 14:00	01 RAW BLEND			0.270	0.270	0.150	0.185		
007	13	7/19/2017 14:00	05 POX A,B,C,D	1.54	0.2	0.280	0.230	0.117	0.091	7.29	
007	13	7/19/2017 14:00	05 POX A,B,C,D							7.38	
007	14	7/19/2017 14:00	21 FILTER A	1.01	1.15	0.080		0.042		7.30	
007	14	7/19/2017 14:00	21 FILTER A							7.31	
007	15	7/19/2017 14:00	22 FILTER B	0.72	1.09	0.060		0.046		7.29	
007	15	7/19/2017 14:00	22 FILTER B							7.28	

Page	Row	Date and Time	SAMPLE LOCATION	Cl2 (f)	Cl2 (t)	Fe(t)	Fe (d)	Mn(t)	Mn (d)	pH	Temp
007	16	7/19/2017 14:00	23 FILTER C	0.9	1.11	0.080		0.079		7.28	
007	16	7/19/2017 14:00	23 FILTER C							7.29	
007	17	7/19/2017 14:00	24 FILTER D	0.85	0.88	0.050		0.103		7.27	
007	17	7/19/2017 14:00	24 FILTER D							7.25	
009	02	7/19/2017 19:00	21 FILTER A			0.040		0.029			
009	03	7/19/2017 19:00	22 FILTER B			0.010		0.011			
009	04	7/19/2017 23:00	21 FILTER A			0.030		0.027			
009	05	7/19/2017 23:00	22 FILTER B			0.020		0.000			
009	06	7/20/2017 3:00	21 FILTER A			0.030		0.002			
009	07	7/20/2017 3:00	22 FILTER B			0.010		0.000			
008	06	7/20/2017 8:30	02 MAHER WELL 1			0.410	0.430	0.121	0.119	5.97	
008	06	7/20/2017 8:30	02 MAHER WELL 1							5.85	
008	07	7/20/2017 8:30	04 MAHER WELL 3			0.040	0.040	0.134	0.135		
008	07	7/20/2017 8:30	04 MAHER WELL 3								
008	11	7/20/2017 8:50	05 POX A,B,C,D								
008	12	7/20/2017 8:50	21 FILTER A	0.55	0.85	0.030		0.007		6.08	
008	12	7/20/2017 8:50	21 FILTER A							6.04	
008	13	7/20/2017 8:50	22 FILTER B	0.48	0.67	0.030		0.001		6.08	
008	13	7/20/2017 8:50	22 FILTER B							6.07	
008	14	7/20/2017 8:50	23 FILTER C	0.63	0.8	0.040		0.015		6.07	
008	14	7/20/2017 8:50	23 FILTER C							6.08	
008	15	7/20/2017 8:50	24 FILTER D	0.58	0.68	0.060		0.018		6.13	
008	15	7/20/2017 8:50	24 FILTER D							6.15	
008	10	7/20/2017 8:50	05 POX A,B,C,D	1.25	0.94	0.200	0.040	0.090	0.064		
009	11	7/20/2017 14:20	05 POX A,B,C,D							6.14	
009	13	7/20/2017 14:20	21 FILTER A	0.83	0.76	0.030		0.002		6.20	
009	13	7/20/2017 14:20	21 FILTER A							6.16	
009	14	7/20/2017 14:20	22 FILTER B	0.49	0.58	0.030		0.009		6.32	
009	14	7/20/2017 14:20	22 FILTER B							6.25	
009	15	7/20/2017 14:20	23 FILTER C	0.65	66	0.030		0.005		6.29	

Page	Row	Date and Time	SAMPLE LOCATION	Cl2 (f)	Cl2 (t)	Fe(t)	Fe (d)	Mn(t)	Mn (d)	pH	Temp
009	15	7/20/2017 14:20	23 FILTER C							6.19	
009	16	7/20/2017 14:20	24 FILTER D	0.42	0.53	0.030		0.001			
009	16	7/20/2017 14:20	24 FILTER D								
009	10	7/20/2017 14:20	01 RAW BLEND			0.250		0.108			
009	11	7/20/2017 14:20	05 POX A,B,C,D	0.96	0.92	0.180	0.040	0.100	0.080	6.24	
009	22	7/20/2017 19:00	21 FILTER A			0.020		0.010			
009	23	7/20/2017 19:00	22 FILTER B			0.020		0.005			
009	24	7/20/2017 23:00	21 FILTER A			0.010		0.005			
009	25	7/20/2017 23:00	22 FILTER B			0.010		0.010			
010	01	7/21/2017 3:00	21 FILTER A			0.010		0.004			
010	02	7/21/2017 3:00	22 FILTER B			0.010		0.007			
010	07	7/21/2017 8:15	01 RAW BLEND			0.110		0.097		5.75	
010	07	7/21/2017 8:15	01 RAW BLEND							5.63	
010	08	7/21/2017 8:15	02 MAHER WELL 1			0.200		0.075			
010	09	7/21/2017 8:15	04 MAHER WELL 3			0.070		0.091			
010	10	7/21/2017 8:15	05 POX A,B,C,D	0.49	0.74	0.080	0.030	0.073	0.064	6.70	
010	10	7/21/2017 8:15	05 POX A,B,C,D							6.66	
010	11	7/21/2017 8:15	21 FILTER A	0.37	0.56	0.020		0.001		6.61	
010	11	7/21/2017 8:15	21 FILTER A							6.50	
010	12	7/21/2017 8:15	22 FILTER B	0.35	0.45	0.020		0.008		6.57	
010	12	7/21/2017 8:15	22 FILTER B							6.50	
010	13	7/21/2017 8:15	23 FILTER C	0.32	0.49	0.020		0.007		6.59	
010	13	7/21/2017 8:15	23 FILTER C							6.52	
010	14	7/21/2017 8:15	24 FILTER D	0.3	0.4	0.020		0.004		6.60	
010	14	7/21/2017 8:15	24 FILTER D							6.60	
010	19	7/21/2017 10:15	01 RAW BLEND			0.110		0.026		5.71	
010	19	7/21/2017 10:15	01 RAW BLEND							5.62	
010	20	7/21/2017 10:15	05 POX A,B,C,D	0.73	0.53	0.160	0.110	0.058	0.056	6.79	
010	20	7/21/2017 10:15	05 POX A,B,C,D							6.81	
010	22	7/21/2017 10:15	21 FILTER A	0.69	0.58	0.030		0.000		6.76	

Page	Row	Date and Time	SAMPLE LOCATION	Cl2 (f)	Cl2 (t)	Fe(t)	Fe (d)	Mn(t)	Mn (d)	pH	Temp
010	22	7/21/2017 10:15	21 FILTER A							6.70	
010	23	7/21/2017 10:15	22 FILTER B	0.47	0.5	0.020		0.000		6.77	
010	23	7/21/2017 10:15	22 FILTER B							6.65	
010	24	7/21/2017 10:15	23 FILTER C	0.42	0.45	0.030		0.000		6.74	
010	24	7/21/2017 10:15	23 FILTER C							6.66	
010	25	7/21/2017 10:15	24 FILTER D	0.44	0.45	0.020		0.000		7.76	
010	25	7/21/2017 10:15	24 FILTER D							6.70	
011	02	7/21/2017 12:15	21 FILTER A			0.020		0.000		6.80	
011	02	7/21/2017 12:15	21 FILTER A							6.70	
011	03	7/21/2017 12:15	22 FILTER B			0.020		0.002		6.74	
011	03	7/21/2017 12:15	22 FILTER B							6.66	
011	04	7/21/2017 12:15	23 FILTER C			0.020		0.001		6.78	
011	04	7/21/2017 12:15	23 FILTER C							6.66	
011	05	7/21/2017 12:15	24 FILTER D			0.020		0.003		6.68	
011	05	7/21/2017 12:15	24 FILTER D							6.66	
011	01	7/21/2017 12:15	01 RAW BLEND			0.160		0.028		5.65	
011	01	7/21/2017 12:15	01 RAW BLEND							5.57	
012	09	7/24/2017 10:50	01 RAW BLEND			0.040		0.140		6.05	
012	09	7/24/2017 10:50	01 RAW BLEND							5.75	
012	10	7/24/2017 10:50	05 POX A,B,C,D	0.79	0.92	0.030	0.020	0.111	0.078	6.68	
012	10	7/24/2017 10:50	05 POX A,B,C,D							6.63	
012	12	7/24/2017 10:50	21 FILTER A	0.61	0.75	0.020		0.033		6.75	
012	12	7/24/2017 10:50	21 FILTER A							6.69	
012	13	7/24/2017 10:50	22 FILTER B	0.5	0.54	0.010		0.035		6.79	
012	13	7/24/2017 10:50	22 FILTER B							6.69	
012	14	7/24/2017 10:50	23 FILTER C	0.49	0.53	0.020		0.033		6.79	
012	14	7/24/2017 10:50	23 FILTER C							6.69	
012	15	7/24/2017 10:50	24 FILTER D	0.42	0.53	0.010		0.039		6.80	
012	15	7/24/2017 10:50	24 FILTER D							6.70	
012	18	7/24/2017 13:00	05 POX A,B,C,D	0.61	0.74	0.020	0.030	0.063	0.064	6.76	

Page	Row	Date and Time	SAMPLE LOCATION	Cl2 (f)	Cl2 (t)	Fe(t)	Fe (d)	Mn(t)	Mn (d)	pH	Temp
012	18	7/24/2017 13:00	05 POX A,B,C,D							6.70	
012	19	7/24/2017 13:00	21 FILTER A	0.48	0.59	0.020		0.000		6.85	
012	19	7/24/2017 13:00	21 FILTER A							6.78	
012	20	7/24/2017 13:00	22 FILTER B	0.32	0.52	0.000		0.000		6.83	
012	20	7/24/2017 13:00	22 FILTER B							6.76	
012	21	7/24/2017 13:00	23 FILTER C	0.41	0.5	0.020		0.000		6.86	
012	21	7/24/2017 13:00	23 FILTER C							6.78	
012	22	7/24/2017 13:00	24 FILTER D	0.37	0.43	0.000		0.000		6.86	
012	22	7/24/2017 13:00	24 FILTER D							6.77	
012	17	7/24/2017 13:00	01 RAW BLEND			0.050		0.103		5.96	
012	17	7/24/2017 13:00	01 RAW BLEND							5.74	
013	02	7/24/2017 14:30	05 POX A,B,C,D	0.7	0.83	0.030	0.020	0.072	0.062	6.88	
013	02	7/24/2017 14:30	05 POX A,B,C,D							7.07	
013	03	7/24/2017 14:30	21 FILTER A	0.38	0.63	0.010		0.016		6.88	
013	03	7/24/2017 14:30	21 FILTER A							6.94	
013	04	7/24/2017 14:30	22 FILTER B	0.43	0.54	0.010		0.009		6.89	
013	04	7/24/2017 14:30	22 FILTER B							6.94	
013	05	7/24/2017 14:30	23 FILTER C	0.3	0.52	0.000		0.002		6.87	
013	05	7/24/2017 14:30	23 FILTER C							6.95	
013	06	7/24/2017 14:30	24 FILTER D	0.36	0.44	0.100		0.009		6.79	
013	06	7/24/2017 14:30	24 FILTER D							6.90	
013	01	7/24/2017 14:30	01 RAW BLEND			0.400		0.102		6.09	
013	01	7/24/2017 14:30	01 RAW BLEND							5.79	
013	12	7/24/2017 17:00	21 FILTER A			0.020		0.031			
013	13	7/24/2017 17:00	22 FILTER B			0.010		0.026			
013	14	7/24/2017 19:00	21 FILTER A			0.000		0.018			
013	15	7/24/2017 19:00	22 FILTER B			0.02		0.029			
013	21	7/25/2017 10:15	01 RAW BLEND			0.020		0.110		5.77	
013	21	7/25/2017 10:15	01 RAW BLEND							5.54	
013	22	7/25/2017 10:15	05 POX A,B,C,D	0.63	0.99	0.020	0.02	0.070	0.057	6.52	

Page	Row	Date and Time	SAMPLE LOCATION	Cl2 (f)	Cl2 (t)	Fe(t)	Fe (d)	Mn(t)	Mn (d)	pH	Temp
013	22	7/25/2017 10:15	05 POX A,B,C,D							6.55	
013	23	7/25/2017 10:15	21 FILTER A	0.53	0.7	0.000		0.000		6.65	
013	23	7/25/2017 10:15	21 FILTER A							6.70	
013	24	7/25/2017 10:15	22 FILTER B	0.34	0.53	0.010		0.000		6.67	
013	24	7/25/2017 10:15	22 FILTER B							6.72	
013	25	7/25/2017 10:15	23 FILTER C	0.43	0.5	0.000		0.000		6.67	
013	25	7/25/2017 10:15	23 FILTER C							6.73	
014	01	7/25/2017 10:15	24 FILTER D	0.43	0.5	0.000		0.002		6.77	
014	01	7/25/2017 10:15	24 FILTER D							6.75	
014	08	7/25/2017 13:00	05 POX A,B,C,D	0.62	0.85	0.020	0.010	0.550	0.053	6.75	
014	08	7/25/2017 13:00	05 POX A,B,C,D							6.74	
014	09	7/25/2017 13:00	21 FILTER A	0.44	0.67	0.010		0.004		6.66	
014	09	7/25/2017 13:00	21 FILTER A							6.76	
014	10	7/25/2017 13:00	22 FILTER B	0.35	0.53	0.010		0.009		6.79	
014	10	7/25/2017 13:00	22 FILTER B							6.79	
014	11	7/25/2017 13:00	23 FILTER C	0.43	0.5	0.000		0.010		6.79	
014	11	7/25/2017 13:00	23 FILTER C							6.81	
014	12	7/25/2017 13:00	24 FILTER D	0.27	0.43	0.010		0.002		6.80	
014	12	7/25/2017 13:00	24 FILTER D							6.82	
014	07	7/25/2017 13:00	01 RAW BLEND			0.020		0.094		5.86	
014	07	7/25/2017 13:00	01 RAW BLEND							5.61	
015	02	7/26/2017 10:20	02 MAHER WELL 1			0.170		0.135		5.87	
015	02	7/26/2017 10:20	02 MAHER WELL 1							5.80	
015	03	7/26/2017 10:20	04 MAHER WELL 3			0.020		0.108		5.66	
015	03	7/26/2017 10:20	04 MAHER WELL 3							5.58	
015	08	7/26/2017 10:20	05 POX A,B,C,D	0.76	0.83	0.100	0.030	0.076	0.046	6.76	
015	08	7/26/2017 10:20	05 POX A,B,C,D							6.78	
015	04	7/26/2017 10:20	21 FILTER A	0.44	0.7	0.020		0.004		6.58	
015	04	7/26/2017 10:20	21 FILTER A							6.69	
015	05	7/26/2017 10:20	22 FILTER B	0.31	0.54	0.020		0.000		6.65	

Page	Row	Date and Time	SAMPLE LOCATION	Cl2 (f)	Cl2 (t)	Fe(t)	Fe (d)	Mn(t)	Mn (d)	pH	Temp
015	05	7/26/2017 10:20	22 FILTER B							6.72	
015	06	7/26/2017 10:20	23 FILTER C	0.37	0.51	0.030		0.000		6.67	
015	06	7/26/2017 10:20	23 FILTER C							6.75	
015	07	7/26/2017 10:20	24 FILTER D	0.37	0.5	0.000		0.001		6.65	
015	07	7/26/2017 10:20	24 FILTER D							6.71	
015	01	7/26/2017 10:20	01 RAW BLEND			0.080		0.090		5.98	
015	01	7/26/2017 10:20	01 RAW BLEND							5.92	
015	11	7/26/2017 13:00	05 POX A,B,C,D	0.43	0.83	0.100	0.030	0.067	0.037	6.65	
015	11	7/26/2017 13:00	05 POX A,B,C,D							6.74	
015	12	7/26/2017 13:00	21 FILTER A	0.49	0.66	0.010		0.009		6.77	
015	12	7/26/2017 13:00	21 FILTER A							6.77	
015	13	7/26/2017 13:00	22 FILTER B	0.45	0.51	0.000		0.014		6.74	
015	13	7/26/2017 13:00	22 FILTER B							6.78	
015	14	7/26/2017 13:00	23 FILTER C	0.39	0.5	0.040		0.000		6.76	
015	14	7/26/2017 13:00	23 FILTER C							6.79	
015	15	7/26/2017 13:00	24 FILTER D	0.25	0.44	0.040		0.000		6.78	
015	15	7/26/2017 13:00	24 FILTER D							6.81	
015	10	7/26/2017 13:00	01 RAW BLEND			0.110		0.074		5.91	
015	10	7/26/2017 13:00	01 RAW BLEND							5.82	
016	10	7/26/2017 18:00	21 FILTER A			0.000		0.000			
016	11	7/26/2017 18:00	22 FILTER B			0.010		0.005			
016	12	7/27/2017 0:00	21 FILTER A			0.020		0.016			
016	13	7/27/2017 0:00	22 FILTER B			0.010		0.020			
016	14	7/27/2017 6:00	21 FILTER A			0.020		0.022			
016	15	7/27/2017 6:00	22 FILTER B			0.010		0.017			
015	20	7/27/2017 8:15	01 RAW BLEND			0.010		0.079		5.68	
015	20	7/27/2017 8:15	01 RAW BLEND							5.62	
015	21	7/27/2017 8:15	05 POX A,B,C,D	0.55	0.82	0.020	0.030	0.060	0.059	6.80	
015	21	7/27/2017 8:15	05 POX A,B,C,D							6.79	
015	22	7/27/2017 8:15	21 FILTER A	0.4	0.69	0.000		0.004		6.48	

Page	Row	Date and Time	SAMPLE LOCATION	Cl2 (f)	Cl2 (t)	Fe(t)	Fe (d)	Mn(t)	Mn (d)	pH	Temp
015	22	7/27/2017 8:15	21 FILTER A							6.67	
015	23	7/27/2017 8:15	22 FILTER B	0.35	0.53	0.010		0.000		6.59	
015	23	7/27/2017 8:15	22 FILTER B							6.60	
015	24	7/27/2017 8:15	23 FILTER C	0.31	0.52	0.010		0.001		6.65	
015	24	7/27/2017 8:15	23 FILTER C							6.65	
015	25	7/27/2017 8:15	24 FILTER D	0.31	0.48	0.010		0.000		6.72	
015	25	7/27/2017 8:15	24 FILTER D							6.73	
017	01	7/27/2017 12:30	05 POX A,B,C,D	0.83	0.93						
017	02	7/27/2017 12:30	21 FILTER A	0.79	0.79						
017	03	7/27/2017 12:30	22 FILTER B	0.66	0.6						
017	04	7/27/2017 12:30	23 FILTER C	0.43	0.61						
017	05	7/27/2017 12:30	24 FILTER D	0.49	0.49						
017	07	7/27/2017 13:15	01 RAW BLEND			0.090		0.095		5.67	
017	07	7/27/2017 13:15	01 RAW BLEND							5.70	
017	08	7/27/2017 13:15	02 MAHER WELL 1			0.160		0.076		5.75	
017	08	7/27/2017 13:15	02 MAHER WELL 1							5.72	
017	09	7/27/2017 13:15	04 MAHER WELL 3			0.020		0.091		5.68	
017	09	7/27/2017 13:15	04 MAHER WELL 3							5.62	
017	10	7/27/2017 13:15	05 POX A,B,C,D	0.74	0.9	0.090	0.040	0.061	0.051	6.70	
017	10	7/27/2017 13:15	05 POX A,B,C,D							6.72	
017	11	7/27/2017 13:15	21 FILTER A	0.59	0.76	0.020		0.004		6.75	
017	11	7/27/2017 13:15	21 FILTER A							6.83	
017	12	7/27/2017 13:15	22 FILTER B	0.51	0.56	0.010		0.007		6.74	
017	12	7/27/2017 13:15	22 FILTER B							6.75	
017	13	7/27/2017 13:15	23 FILTER C	0.5	0.58	0.000		0.003		6.75	
017	13	7/27/2017 13:15	23 FILTER C							6.76	
017	14	7/27/2017 13:15	24 FILTER D	0.41	0.46	0.030		0.000		6.76	
017	14	7/27/2017 13:15	24 FILTER D							6.74	
018	03	7/27/2017 18:00	21 FILTER A			0.020		0.008			
018	04	7/27/2017 18:00	22 FILTER B			0.010		0.000			

Page	Row	Date and Time	SAMPLE LOCATION	Cl2 (f)	Cl2 (t)	Fe(t)	Fe (d)	Mn(t)	Mn (d)	pH	Temp
018	05	7/28/2017 0:00	21 FILTER A			0.040		0.003			
018	06	7/28/2017 0:00	22 FILTER B			0.050		0.007			
018	07	7/28/2017 6:00	21 FILTER A			0.010		0.000			
018	08	7/28/2017 6:00	22 FILTER B			0.020		0.004			
017	18	7/28/2017 8:00	01 RAW BLEND			0.040		0.092		5.88	
017	18	7/28/2017 8:00	01 RAW BLEND							5.61	
017	19	7/28/2017 8:00	02 MAHER WELL 1			0.170		0.095		5.84	
017	19	7/28/2017 8:00	02 MAHER WELL 1							5.68	
017	20	7/28/2017 8:00	04 MAHER WELL 3			0.020		0.105		5.78	
017	20	7/28/2017 8:00	04 MAHER WELL 3							5.63	
017	21	7/28/2017 8:00	05 POX A,B,C,D	0.56	0.85	0.040	0.020	0.059	0.044	6.88	
017	21	7/28/2017 8:00	05 POX A,B,C,D							6.83	
017	22	7/28/2017 8:00	21 FILTER A	0.38	0.69	0.000		0.008		6.71	
017	22	7/28/2017 8:00	21 FILTER A							6.72	
017	23	7/28/2017 8:00	22 FILTER B	0.31	0.54	0.000		0.017		6.75	
017	23	7/28/2017 8:00	22 FILTER B							6.73	
017	24	7/28/2017 8:00	23 FILTER C	0.37	0.47	0.000		0.022		6.77	
017	24	7/28/2017 8:00	23 FILTER C							6.70	
017	25	7/28/2017 8:00	24 FILTER D	0.27	0.4	0.000		0.023		6.78	
017	25	7/28/2017 8:00	24 FILTER D							6.71	
018	17	7/28/2017 13:00	05 POX A,B,C,D	0.75	1.07	0.060	0.050	0.074	0.064	6.59	
018	17	7/28/2017 13:00	05 POX A,B,C,D							6.60	
018	18	7/28/2017 13:00	21 FILTER A	0.8	1.03	0.010		0.030		6.71	
018	18	7/28/2017 13:00	21 FILTER A							6.69	
018	19	7/28/2017 13:00	22 FILTER B	0.61	0.73	0.020		0.009		6.73	
018	19	7/28/2017 13:00	22 FILTER B							6.74	
018	20	7/28/2017 13:00	23 FILTER C	0.62	0.76	0.040		0.011		6.72	
018	20	7/28/2017 13:00	23 FILTER C							6.68	
018	21	7/28/2017 13:00	24 FILTER D	0.52	0.64	0.020		0.006		6.72	
018	21	7/28/2017 13:00	24 FILTER D							6.71	

Page	Row	Date and Time	SAMPLE LOCATION	Cl2 (f)	Cl2 (t)	Fe(t)	Fe (d)	Mn(t)	Mn (d)	pH	Temp
018	16	7/28/2017 13:00	01 RAW BLEND			0.070		0.094		5.79	
018	16	7/28/2017 13:00	01 RAW BLEND							5.60	
019	02	7/28/2017 17:00	21 FILTER A			0.020		0.000			
019	03	7/28/2017 17:00	22 FILTER B			0.010		0.009			
019	04	7/28/2017 23:00	21 FILTER A			0.030		0.001			
019	05	7/28/2017 23:00	22 FILTER B			0.010		0.017			
019	06	7/29/2017 5:00	21 FILTER A			0.020		0.007			
019	07	7/29/2017 5:00	22 FILTER B			0.010		0.031			
019	08	7/29/2017 11:00	21 FILTER A			0.020		0.000			
019	09	7/29/2017 11:00	22 FILTER B			0.000		0.022			
019	10	7/29/2017 17:00	21 FILTER A			0.020		0.014			
019	11	7/29/2017 17:00	22 FILTER B			0.000		0.012			
019	12	7/29/2017 23:00	21 FILTER A			0.010		0.001			
019	13	7/29/2017 23:00	22 FILTER B			0.010		0.004			
019	14	7/30/2017 5:00	21 FILTER A			0.040		0.000			
019	15	7/30/2017 5:00	22 FILTER B			0.010		0.020			
019	16	7/30/2017 11:00	21 FILTER A			0.010		0.000			
019	17	7/30/2017 11:00	22 FILTER B			0.010		0.030			
019	18	7/30/2017 17:00	21 FILTER A			0.010		0.010			
019	19	7/30/2017 17:00	22 FILTER B			0.010		0.000			
019	20	7/30/2017 23:00	21 FILTER A			0.020		0.007			
019	21	7/30/2017 23:00	22 FILTER B			0.010		0.000			
019	22	7/31/2017 5:00	21 FILTER A			0.020		0.015			
019	23	7/31/2017 5:00	22 FILTER B			0.01		0.0			
020	01	7/31/2017 9:30	01 RAW BLEND			0.340		0.097		5.80	
020	01	7/31/2017 9:30	01 RAW BLEND							5.64	
021	13	7/31/2017 9:30	01 RAW BLEND			0.390		0.125			
020	02	7/31/2017 9:30	05 POX A,B,C,D	1.03	1.31	0.060	0.100	0.127	0.770	6.67	
020	02	7/31/2017 9:30	05 POX A,B,C,D							6.66	
021	14	7/31/2017 9:30	05 POX A,B,C,D	1.32		0.120		0.108			

Page	Row	Date and Time	SAMPLE LOCATION	Cl2 (f)	Cl2 (t)	Fe(t)	Fe (d)	Mn(t)	Mn (d)	pH	Temp
020	03	7/31/2017 9:30	21 FILTER A	0.86	1.11	0.020		0.025		6.32	
020	03	7/31/2017 9:30	21 FILTER A							6.31	
021	15	7/31/2017 9:30	21 FILTER A			0.120		0.049			
020	04	7/31/2017 9:30	22 FILTER B	0.69	0.91	0.030		0.029		6.49	
020	04	7/31/2017 9:30	22 FILTER B							6.48	
021	16	7/31/2017 9:30	22 FILTER B			0.100		0.048			
020	05	7/31/2017 9:30	23 FILTER C	0.71	0.85	0.030		0.034		6.55	
020	05	7/31/2017 9:30	23 FILTER C							6.51	
021	17	7/31/2017 9:30	23 FILTER C			0.050		0.033			
020	06	7/31/2017 9:30	24 FILTER D	0.59	0.68	0.010		0.014		6.61	
020	06	7/31/2017 9:30	24 FILTER D							6.55	
021	18	7/31/2017 9:30	24 FILTER D			0.040		0.038			
021	09	7/31/2017 16:00	01 RAW BLEND				0.340		0.101		
021	21	7/31/2017 17:00	21 FILTER A			0.040		0.029			
021	22	7/31/2017 17:00	23 FILTER C			0.040		0.006			
021	23	7/31/2017 23:00	21 FILTER A			0.060		0.019			
021	24	7/31/2017 23:00	23 FILTER C			0.070		0.013			
021	25	8/1/2017 5:00	21 FILTER A			0.040		0.000			
021	26	8/1/2017 5:00	23 FILTER C			0.060		0.009			
022	02	8/1/2017 8:30	05 POX A,B,C,D	1.22	1.48	0.070	0.010	0.253	0.034	6.57	14.8
022	02	8/1/2017 8:30	05 POX A,B,C,D							6.68	14.7
022	03	8/1/2017 8:30	21 FILTER A	1.04	1.3	0.000		0.000		6.67	15.0
022	03	8/1/2017 8:30	21 FILTER A							6.82	15.0
022	04	8/1/2017 8:30	22 FILTER B	0.94	1.31	0.010		0.003		6.66	15.1
022	04	8/1/2017 8:30	22 FILTER B							6.64	15.0
022	05	8/1/2017 8:30	23 FILTER C	0.65	0.81	0.000		0.026		6.63	14.8
022	05	8/1/2017 8:30	23 FILTER C							6.62	14.7
022	06	8/1/2017 8:30	24 FILTER D	0.8	0.83	0.000		0.038		6.65	14.9
022	06	8/1/2017 8:30	24 FILTER D							6.64	14.8
022	01	8/1/2017 8:30	01 RAW BLEND			0.070		0.081		5.79	15.0

Page	Row	Date and Time	SAMPLE LOCATION	Cl2 (f)	Cl2 (t)	Fe(t)	Fe (d)	Mn(t)	Mn (d)	pH	Temp
022	01	8/1/2017 8:30	01 RAW BLEND							5.81	14.9
022	15	8/1/2017 9:05	02 MAHER WELL 1			0.080		0.048			
022	16	8/1/2017 9:05	03 MAHER WELL 2			0.100		0.161			
023	12	8/1/2017 14:30	01 RAW BLEND							5.67	15.1
023	12	8/1/2017 14:30	01 RAW BLEND							5.86	15.0
023	13	8/1/2017 14:30	05 POX A,B,C,D	1.06	1.16					6.47	
023	13	8/1/2017 14:30	05 POX A,B,C,D							6.63	
023	14	8/1/2017 14:30	21 FILTER A	1	0.99						
023	15	8/1/2017 14:30	22 FILTER B	1.17	1						
023	16	8/1/2017 14:30	23 FILTER C	0.75	0.59						
023	17	8/1/2017 14:30	24 FILTER D	0.74	0.62						
024	11	8/1/2017 17:00	21 FILTER A			0.040		0.003			
024	12	8/1/2017 17:00	23 FILTER C			0.050		0.000			
024	13	8/1/2017 23:00	21 FILTER A			0.050		0.002			
024	14	8/1/2017 23:00	23 FILTER C			0.050		0.000			
024	15	8/2/2017 5:00	21 FILTER A			0.060		0.004			
024	16	8/2/2017 5:00	23 FILTER C			0.050		0.000			
024	18	8/2/2017 8:15	01 RAW BLEND			0.160		0.040		5.86	14.9
024	18	8/2/2017 8:15	01 RAW BLEND							5.86	14.9
024	19	8/2/2017 8:15	05 POX A,B,C,D	0.6	0.86	0.130	0.100	0.056	0.041	6.72	
024	19	8/2/2017 8:15	05 POX A,B,C,D							6.71	
024	20	8/2/2017 8:15	21 FILTER A	0.55	0.75	0.050		0.001		6.71	
024	20	8/2/2017 8:15	21 FILTER A							6.80	
024	21	8/2/2017 8:15	22 FILTER B	0.44	0.79	0.040		0.000		6.72	
024	21	8/2/2017 8:15	22 FILTER B							6.68	
024	22	8/2/2017 8:15	23 FILTER C	0.41	0.43	0.050		0.019		6.70	
024	22	8/2/2017 8:15	23 FILTER C							6.78	
024	23	8/2/2017 8:15	24 FILTER D	0.4	0.45	0.030		0.022		6.71	
024	23	8/2/2017 8:15	24 FILTER D							6.69	
025	17	8/2/2017 10:30	01 RAW BLEND			0.140		0.045			

Page	Row	Date and Time	SAMPLE LOCATION	Cl2 (f)	Cl2 (t)	Fe(t)	Fe (d)	Mn(t)	Mn (d)	pH	Temp
025	14	8/2/2017 10:30	02 MAHER WELL 1			0.160		0.095			
025	15	8/2/2017 10:30	03 MAHER WELL 2			0.120		0.050			
025	16	8/2/2017 10:30	05 POX A,B,C,D	0.81	0.87	0.120		0.031			
025	18	8/2/2017 10:30	21 FILTER A			0.070		0.007			
025	19	8/2/2017 10:30	22 FILTER B			0.080		0.009			
025	20	8/2/2017 10:30	23 FILTER C			0.080		0.015			
025	21	8/2/2017 10:30	24 FILTER D			0.070		0.016			
026	01	8/2/2017 13:15	01 RAW BLEND			0.080		0.045		5.69	14.5
026	01	8/2/2017 13:15	01 RAW BLEND							5.78	14.4
026	02	8/2/2017 13:15	05 POX A,B,C,D	0.57	0.74	0.110		0.046	0.040	6.45	
026	02	8/2/2017 13:15	05 POX A,B,C,D							6.71	
026	03	8/2/2017 13:15	21 FILTER A	0.33	0.53	0.040		0.000		6.50	
026	03	8/2/2017 13:15	21 FILTER A							6.77	
026	04	8/2/2017 13:15	22 FILTER B	0.52	0.59	0.040		0.001		6.60	
026	04	8/2/2017 13:15	22 FILTER B							6.78	
026	05	8/2/2017 13:15	23 FILTER C	0.48	0.52	0.040		0.001		6.60	
026	05	8/2/2017 13:15	23 FILTER C							6.71	
026	06	8/2/2017 13:15	24 FILTER D	0.4	0.47	0.030		0.000		6.63	
026	06	8/2/2017 13:15	24 FILTER D							6.81	
026	15	8/2/2017 17:00	21 FILTER A			0.030		0.000			
026	16	8/2/2017 17:00	23 FILTER C			0.050		0.005			
026	17	8/2/2017 23:00	21 FILTER A			0.050		0.003			
026	18	8/2/2017 23:00	23 FILTER C			0.070		0.000			
026	20	8/3/2017 5:00	21 FILTER A			0.080		0.005			
026	21	8/3/2017 5:00	23 FILTER C			0.080		0.000			
027	01	8/3/2017 8:00	01 RAW BLEND			0.040		0.035		5.97	14.2
027	01	8/3/2017 8:00	01 RAW BLEND							5.76	14.1
027	02	8/3/2017 8:00	05 POX A,B,C,D	0.6	0.81	0.030	0.020	0.040	0.034	6.76	
027	02	8/3/2017 8:00	05 POX A,B,C,D							6.85	
027	03	8/3/2017 8:00	21 FILTER A	0.59	0.71	0.000		0.008		6.79	

Page	Row	Date and Time	SAMPLE LOCATION	Cl2 (f)	Cl2 (t)	Fe(t)	Fe (d)	Mn(t)	Mn (d)	pH	Temp
027	03	8/3/2017 8:00	21 FILTER A							6.83	
027	04	8/3/2017 8:00	22 FILTER B	0.45	0.64	0.000		0.007		6.80	
027	04	8/3/2017 8:00	22 FILTER B							6.80	
027	05	8/3/2017 8:00	23 FILTER C	0.13	0.41	0.020		0.001		6.79	
027	05	8/3/2017 8:00	23 FILTER C							6.82	
027	06	8/3/2017 8:00	24 FILTER D	0.29	342	0.000		0.004		6.84	
027	06	8/3/2017 8:00	24 FILTER D							6.67	
027	16	8/3/2017 9:15	05 POX A,B,C,D	0.79	1.05						
028	03	8/3/2017 12:00	01 RAW BLEND			0.180		0.043			
028	01	8/3/2017 12:00	02 MAHER WELL 1			0.180		0.041			
028	02	8/3/2017 12:00	03 MAHER WELL 2			0.190		0.025			
028	04	8/3/2017 12:00	05 POX A,B,C,D			0.110		0.053			
028	05	8/3/2017 12:00	21 FILTER A			0.070		0.002			
028	06	8/3/2017 12:00	22 FILTER B			0.080		0.008			
028	07	8/3/2017 12:00	23 FILTER C			0.080		0.011			
028	08	8/3/2017 12:00	24 FILTER D			0.080		0.005			
028	14	8/3/2017 13:30	01 RAW BLEND			0.080		0.032		6.02	14.6
028	14	8/3/2017 13:30	01 RAW BLEND							5.85	14.5
028	15	8/3/2017 13:30	05 POX A,B,C,D	2.02	2.42	0.080	0.070	0.112	0.070	6.70	
028	15	8/3/2017 13:30	05 POX A,B,C,D							6.88	
028	16	8/3/2017 13:30	21 FILTER A	1.64	1.8	0.030		0.007		6.83	
028	16	8/3/2017 13:30	21 FILTER A							6.86	
028	17	8/3/2017 13:30	22 FILTER B	1.65	1.9	0.030		0.009		6.85	
028	17	8/3/2017 13:30	22 FILTER B							6.80	
028	18	8/3/2017 13:30	23 FILTER C	1.07	1.32	0.040		0.012		6.87	
028	18	8/3/2017 13:30	23 FILTER C							6.81	
028	19	8/3/2017 13:30	24 FILTER D	1	1.32	0.040		0.019		6.83	
028	19	8/3/2017 13:30	24 FILTER D							6.79	
028	21	8/3/2017 13:40	05 POX A,B,C,D	2.26							
028	22	8/3/2017 13:50	05 POX A,B,C,D	1.75							

Page	Row	Date and Time	SAMPLE LOCATION	Cl2 (f)	Cl2 (t)	Fe(t)	Fe (d)	Mn(t)	Mn (d)	pH	Temp
028	23	8/3/2017 14:10	05 POX A,B,C,D	1.21							
029	01	8/3/2017 17:00	21 FILTER A			0.050		0.008			
029	02	8/3/2017 17:00	23 FILTER C			0.010		0.014			
029	03	8/3/2017 23:00	21 FILTER A			0.040		0.014			
029	04	8/3/2017 23:00	23 FILTER C			0.040		0.010			
029	05	8/4/2017 5:00	21 FILTER A			0.030		0.025			
029	06	8/4/2017 5:00	23 FILTER C			0.020		0.015			
029	09	8/4/2017 8:00	01 RAW BLEND			0.040		0.053		5.88	14.2
029	09	8/4/2017 8:00	01 RAW BLEND							5.81	14.2
029	10	8/4/2017 8:00	05 POX A,B,C,D	1.2	1.1	0.030	0.020	0.045	0.034	6.63	
029	10	8/4/2017 8:00	05 POX A,B,C,D							6.71	
029	11	8/4/2017 8:00	21 FILTER A	0.72	1.04	0.010		0.015		6.66	
029	11	8/4/2017 8:00	21 FILTER A							6.73	
029	12	8/4/2017 8:00	22 FILTER B	0.69	1.05	0.010		0.019		6.73	
029	12	8/4/2017 8:00	22 FILTER B							6.77	
029	13	8/4/2017 8:00	23 FILTER C	0.38	0.56	0.000		0.013		6.73	
029	13	8/4/2017 8:00	23 FILTER C							6.79	
029	14	8/4/2017 8:00	24 FILTER D	0.44	0.57	0.010		0.016		6.74	
029	14	8/4/2017 8:00	24 FILTER D							6.73	
029	21	8/4/2017 10:50	01 RAW BLEND			0.140		0.043			
029	19	8/4/2017 10:50	02 MAHER WELL 1			0.170		0.042			
029	20	8/4/2017 10:50	03 MAHER WELL 2			0.170		0.041			
029	22	8/4/2017 10:50	05 POX A,B,C,D	1.2	1.28	0.070		0.255			
029	23	8/4/2017 10:50	21 FILTER A	0.85	0.99	0.060		0.012			
029	24	8/4/2017 10:50	22 FILTER B	0.8	1.01	0.080		0.013			
029	25	8/4/2017 10:50	23 FILTER C	0.47	0.6	0.050		0.016			
029	26	8/4/2017 10:50	24 FILTER D	0.45	0.54	0.050		0.019			

APPENDIX B –Laboratory Results

ANALYTICAL REPORT

Lab Number:	L1725482
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Erik Grotton
Phone:	(508) 248-7094
Project Name:	BARNSTABLE
Project Number:	20107
Report Date:	08/17/17

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1725482
Report Date: 08/17/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1725482-01	RAW-2	DW	MAITEL	07/25/17 11:00	07/25/17
L1725482-02	FILTER A-2	DW	MATTEL	07/25/17 11:00	07/25/17
L1725482-03	FILTER C-2	DW	MATTEL	07/25/17 11:00	07/25/17
L1725482-04	FILTER E-2	DW	MATTEL	07/25/17 11:00	07/25/17
L1725482-05	FILTER F-2	DW	MATTEL	07/25/17 11:00	07/25/17
L1725482-06	UV-2	DW	MATTEL	07/25/17 11:00	07/25/17

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1725482
Report Date: 08/17/17

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. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated 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.

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 table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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 Client Service Representative 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 Client Services at 800-624-9220 with any questions.

Project Name: BARNSTABLE **Lab Number:** L1725482
Project Number: 20107 **Report Date:** 08/17/17

Case Narrative (continued)

Sample Receipt

The samples were not appropriately preserved for the 522 analysis; the analysis was cancelled at the client's request.

Semivolatile Organics

The surrogate recovery is outside the individual acceptance criteria for perfluoro-n-[1,2-13c2]decanoic acid (13c-pfda). The results of the original analysis are reported.

L1725482-01: 136%

L1725482-04: 139%

L1725482-05: 131%

L1725482-06: 142%

The internal standard (IS) response for 13C2-PFOA and 13C-PFOS were above the acceptance criteria; however, re-analysis achieved similar results.

L1725482-01: 131%/178%

L1725482-04: 183%/195%

L1725482-05: 168%/181%

L1725482-06: 178%/186%

WG1027227-2/-3: 132%/131%

WG1027227-1: The surrogate recoveries are above the acceptance criteria for perfluoro-n-[1,2-13c2]hexanoic acid (13c-pfhxa) (132%) and perfluoro-n-[1,2-13c2]decanoic acid (13c-pfda) (153%).

The WG1027227-2 LCS recovery is outside the acceptance criteria for perfluorooctanoic acid (pfoa) (145%).

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: Cristin Walker

Title: Technical Director/Representative Date: 08/17/17

ORGANICS

SEMIVOLATILES

Project Name: BARNSTABLE
Project Number: 20107
Lab Number: L1725482
Report Date: 08/17/17

SAMPLE RESULTS

Lab ID: L1725482-01
Client ID: RAW-2
Sample Location: MAITEL

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/16/17 09:24
Analyst: AR

Date Collected: 07/25/17 11:00
Date Received: 07/25/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 07/31/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	18.6		ng/l	1.85	--	1
Perfluorooctanesulfonic Acid (PFOS)	83.2		ng/l	1.85	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	128		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**136**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	101		70-130

Project Name: BARNSTABLE
Project Number: 20107
Lab Number: L1725482
Report Date: 08/17/17

SAMPLE RESULTS

Lab ID: L1725482-04
Client ID: FILTER E-2
Sample Location: MATTEL

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/16/17 09:33
Analyst: AR

Date Collected: 07/25/17 11:00
Date Received: 07/25/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 07/31/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.85	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.85	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	122		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**139**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	104		70-130

Project Name: BARNSTABLE
Project Number: 20107
Lab Number: L1725482
Report Date: 08/17/17

SAMPLE RESULTS

Lab ID: L1725482-05
Client ID: FILTER F-2
Sample Location: MATTEL

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/16/17 09:43
Analyst: AR

Date Collected: 07/25/17 11:00
Date Received: 07/25/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 07/31/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.85	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.85	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	122		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**131**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	107		70-130

Project Name: BARNSTABLE
Project Number: 20107
Lab Number: L1725482
Report Date: 08/17/17

SAMPLE RESULTS

Lab ID: L1725482-06
Client ID: UV-2
Sample Location: MATTEL

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/16/17 09:52
Analyst: AR

Date Collected: 07/25/17 11:00
Date Received: 07/25/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 07/31/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	19.0		ng/l	1.92	--	1
Perfluorooctanesulfonic Acid (PFOS)	90.6		ng/l	1.92	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	118		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**142**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	98		70-130

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1725482
Report Date: 08/17/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 122,537
Analytical Date: 08/16/17 09:15
Analyst: AR

Extraction Method: EPA 537
Extraction Date: 07/31/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab for sample(s): 01,04-06 Batch: WG1027227-1					
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	**132**	Q	70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**153**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	108		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: BARNSTABLE

Project Number: 20107

Lab Number: L1725482

Report Date: 08/17/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01,04-06 Batch: WG1027227-2 WG1027227-3								
Perfluorooctanoic Acid (PFOA)	**146**	Q	129		70-130	12		30
Perfluorooctanesulfonic Acid (PFOS)	126		117		70-130	7		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	129		125		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**132**	Q	**131**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	104		96		70-130

METALS

Project Name: BARNSTABLE
Project Number: 20107
Lab Number: L1725482
Report Date: 08/17/17

SAMPLE RESULTS

Lab ID: L1725482-01
Client ID: RAW-2
Sample Location: MAITEL
Matrix: Dw

Date Collected: 07/25/17 11:00
Date Received: 07/25/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	07/26/17 10:00	07/27/17 17:20	EPA 3005A	19,200.7	PS
Manganese, Total	0.1154		mg/l	0.0010	--	1	07/26/17 10:00	07/27/17 15:31	EPA 3005A	3,200.8	AM

Project Name: BARNSTABLE
Lab Number: L1725482
Project Number: 20107
Report Date: 08/17/17

SAMPLE RESULTS

Lab ID: L1725482-02
Client ID: FILTER A-2
Sample Location: MATTEL
Matrix: Dw

Date Collected: 07/25/17 11:00
Date Received: 07/25/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	07/26/17 10:00	07/27/17 17:25	EPA 3005A	19,200.7	PS
Manganese, Total	ND		mg/l	0.010	--	1	07/26/17 10:00	07/27/17 17:25	EPA 3005A	19,200.7	PS

Project Name: BARNSTABLE
Lab Number: L1725482
Project Number: 20107
Report Date: 08/17/17

SAMPLE RESULTS

Lab ID: L1725482-03
Client ID: FILTER C-2
Sample Location: MATTEL
Matrix: Dw

Date Collected: 07/25/17 11:00
Date Received: 07/25/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	07/26/17 10:00	07/27/17 17:30	EPA 3005A	19,200.7	PS
Manganese, Total	ND		mg/l	0.010	--	1	07/26/17 10:00	07/27/17 17:30	EPA 3005A	19,200.7	PS

Project Name: BARNSTABLE **Lab Number:** L1725482

Project Number: 20107 **Report Date:** 08/17/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-03 Batch: WG1025831-1										
Iron, Total	ND		mg/l	0.050	--	1	07/26/17 10:00	07/27/17 15:53	19,200.7	PS
Manganese, Total	ND		mg/l	0.010	--	1	07/26/17 10:00	07/27/17 15:53	19,200.7	PS

Prep Information

Digestion Method: EPA 3005A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01 Batch: WG1025832-1										
Manganese, Total	ND		mg/l	0.0010	--	1	07/26/17 10:00	07/27/17 15:06	3,200.8	AM

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis

Batch Quality Control

Project Name: BARNSTABLE

Project Number: 20107

Lab Number: L1725482

Report Date: 08/17/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-03 Batch: WG1025831-2								
Iron, Total	102		-		85-115	-		
Manganese, Total	100		-		85-115	-		
Total Metals - Mansfield Lab Associated sample(s): 01 Batch: WG1025832-2								
Manganese, Total	106		-		85-115	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1725482
Report Date: 08/17/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-03 QC Batch ID: WG1025831-3 QC Sample: L1725414-01 Client ID: MS Sample												
Iron, Total	0.592	1	1.65	106		-	-		75-125	-		20
Manganese, Total	0.159	0.5	0.669	102		-	-		75-125	-		20
Total Metals - Mansfield Lab Associated sample(s): 01-03 QC Batch ID: WG1025831-7 QC Sample: L1725501-03 Client ID: MS Sample												
Iron, Total	0.905	1	2.00	110		-	-		75-125	-		20
Manganese, Total	0.036	0.5	0.551	103		-	-		75-125	-		20
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG1025832-3 QC Sample: L1725414-01 Client ID: MS Sample												
Manganese, Total	0.1609	0.5	0.7088	110		-	-		70-130	-		20

Lab Duplicate Analysis
Batch Quality Control

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1725482
Report Date: 08/17/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-03 QC Batch ID: WG1025831-8 QC Sample: L1725501-03 Client ID: DUP Sample						
Iron, Total	0.905	0.907	mg/l	0		20

INORGANICS
&
MISCELLANEOUS

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1725482
Report Date: 08/17/17

SAMPLE RESULTS

Lab ID: L1725482-01
Client ID: RAW-2
Sample Location: MAITEL
Matrix: Dw

Date Collected: 07/25/17 11:00
Date Received: 07/25/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	ND		NTU	0.20	--	1	-	07/26/17 18:30	44,180.1	AS
Alkalinity, Total	10.0		mg CaCO3/L	2.00	NA	1	-	07/26/17 09:47	121,2320B	BR
pH (H)	5.4		SU	-	NA	1	-	07/26/17 10:50	121,4500H+-B	LH

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1725482
Report Date: 08/17/17

SAMPLE RESULTS

Lab ID: L1725482-02
Client ID: FILTER A-2
Sample Location: MATTEL
Matrix: Dw

Date Collected: 07/25/17 11:00
Date Received: 07/25/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	ND		NTU	0.20	--	1	-	07/25/17 17:18	44,180.1	AS
Alkalinity, Total	47.6		mg CaCO3/L	2.00	NA	1	-	07/26/17 09:47	121,2320B	BR

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1725482
Report Date: 08/17/17

SAMPLE RESULTS

Lab ID: L1725482-03
Client ID: FILTER C-2
Sample Location: MATTEL
Matrix: Dw

Date Collected: 07/25/17 11:00
Date Received: 07/25/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	ND		NTU	0.20	--	1	-	07/25/17 17:18	44,180.1	AS
Alkalinity, Total	48.4		mg CaCO3/L	2.00	NA	1	-	07/26/17 09:47	121,2320B	BR

Project Name: BARNSTABLE
Project Number: 20107
Lab Number: L1725482
Report Date: 08/17/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 02-03 Batch: WG1025618-1										
Turbidity	ND		NTU	0.20	--	1	-	07/25/17 17:18	44,180.1	AS
General Chemistry - Westborough Lab for sample(s): 01-03 Batch: WG1025882-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	07/26/17 09:47	121,2320B	BR
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1026055-1										
Turbidity	ND		NTU	0.20	--	1	-	07/26/17 18:30	44,180.1	AS

Lab Control Sample Analysis

Batch Quality Control

Project Name: BARNSTABLE

Project Number: 20107

Lab Number: L1725482

Report Date: 08/17/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 02-03 Batch: WG1025618-2								
Turbidity	100		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1025859-1								
pH	100		-		99-101	-		5
General Chemistry - Westborough Lab Associated sample(s): 01-03 Batch: WG1025882-2								
Alkalinity, Total	104		-		90-110	-		10
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1026055-2								
Turbidity	100		-		90-110	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1725482
Report Date: 08/17/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-03 QC Batch ID: WG1025882-4 QC Sample: L1725482-01 Client ID: RAW-2												
Alkalinity, Total	10.0	100	109	99		-	-		86-116	-		10

Lab Duplicate Analysis
Batch Quality Control

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1725482
Report Date: 08/17/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 02-03 QC Batch ID: WG1025618-3 QC Sample: L1725501-05 Client ID: DUP Sample						
Turbidity	0.20	0.25	NTU	**22**	Q	13
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1025859-2 QC Sample: L1725482-01 Client ID: RAW-2						
pH (H)	5.4	5.5	SU	2		5
General Chemistry - Westborough Lab Associated sample(s): 01-03 QC Batch ID: WG1025882-3 QC Sample: L1725482-01 Client ID: RAW-2						
Alkalinity, Total	10.0	10.1	mg CaCO3/L	1		10
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1026055-3 QC Sample: L1725644-05 Client ID: DUP Sample						
Turbidity	3.4	3.5	NTU	3		13

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1725482
Report Date: 08/17/17

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(*)
L1725482-01A	Plastic 120ml HNO3 preserved	A	<2	<2	3.9	Y	Absent		MN-2008T(180),FE-UI(180)
L1725482-01B	Plastic 250ml unpreserved/No Headspace	A	NA		3.9	Y	Absent		ALK-T-2320(14),TURB-180(2),PH-4500(.01)
L1725482-01C	Plastic 250ml Trizma preserved	A	NA		3.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1725482-01D	Plastic 250ml Trizma preserved	A	NA		3.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1725482-01E	Plastic 250ml Trizma preserved	A	NA		3.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1725482-01F	Amber 500ml NaSulfite/NaHSO4 preserved	A	7	7	3.9	N	Absent		HOLD-522(28)
L1725482-01G	Amber 500ml NaSulfite/NaHSO4 preserved	A	7	7	3.9	N	Absent		HOLD-522(28)
L1725482-02A	Plastic 120ml HNO3 preserved	A	<2	<2	3.9	Y	Absent		FE-UI(180),MN-UI(180)
L1725482-02B	Plastic 120ml unpreserved	A	7	7	3.9	Y	Absent		TURB-180(2)
L1725482-02C	Plastic 250ml unpreserved/No Headspace	A	NA		3.9	Y	Absent		ALK-T-2320(14)
L1725482-03A	Plastic 120ml HNO3 preserved	A	<2	<2	3.9	Y	Absent		FE-UI(180),MN-UI(180)
L1725482-03B	Plastic 120ml unpreserved	A	7	7	3.9	Y	Absent		TURB-180(2)
L1725482-03C	Plastic 250ml unpreserved/No Headspace	A	NA		3.9	Y	Absent		ALK-T-2320(14)
L1725482-04A	Plastic 250ml Trizma preserved	A	NA		3.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1725482-04B	Plastic 250ml Trizma preserved	A	NA		3.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1725482-04C	Plastic 250ml Trizma preserved	A	NA		3.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1725482-04D	Amber 500ml NaSulfite/NaHSO4 preserved	A	7	7	3.9	N	Absent		HOLD-522(28)
L1725482-04E	Amber 500ml NaSulfite/NaHSO4 preserved	A	7	7	3.9	N	Absent		HOLD-522(28)
L1725482-05A	Plastic 250ml Trizma preserved	A	NA		3.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1725482-05B	Plastic 250ml Trizma preserved	A	NA		3.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1725482-05C	Plastic 250ml Trizma preserved	A	NA		3.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1725482-05D	Amber 500ml NaSulfite/NaHSO4 preserved	A	7	7	3.9	N	Absent		HOLD-522(28)
L1725482-05E	Amber 500ml NaSulfite/NaHSO4 preserved	A	7	7	3.9	N	Absent		HOLD-522(28)

*Values in parentheses indicate holding time in days

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1725482
Report Date: 08/17/17

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1725482-06A	Plastic 250ml Trizma preserved	A	NA		3.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1725482-06B	Plastic 250ml Trizma preserved	A	NA		3.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1725482-06C	Plastic 250ml Trizma preserved	A	NA		3.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1725482-06D	Amber 500ml NaSulfite/NaHSO4 preserved	A	7	7	3.9	N	Absent		HOLD-522(28)
L1725482-06E	Amber 500ml NaSulfite/NaHSO4 preserved	A	7	7	3.9	N	Absent		HOLD-522(28)

Container Comments

L1725482-01F	Cannot be perserve in Login
L1725482-01G	Cannot be perserve in Login
L1725482-04D	Cannot be perserve in Login
L1725482-04E	Cannot be perserve in Login
L1725482-05D	Cannot be perserve in Login
L1725482-05E	Cannot be perserve in Login
L1725482-06D	Cannot be perserve in Login
L1725482-06E	Cannot be perserve in Login

*Values in parentheses indicate holding time in days

Project Name:	BARNSTABLE	**Lab Number:**	L1725482
Project Number:	20107	**Report Date:**	08/17/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	BARNSTABLE	**Lab Number:**	L1725482
Project Number:	20107	**Report Date:**	08/17/17

Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name: BARNSTABLE **Lab Number:** L1725482

Project Number: 20107 **Report Date:** 08/17/17

REFERENCES

3 Methods for the Determination of Metals in Environmental Samples, Supplement I. EPA/600/R-94/111. May 1994.

19 Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

122 Determination of Selected Perfluorintated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). EPA Method 537, EPA/600/R-08/092. Version 1.1, September 2009.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

Serial_No:08171711:53

MANSFIELD CHAIN OF CUSTODY

ALPHA ANALYTICAL

WESTBORO, MA
TEL: 508-898-9220
FAX: 508-898-9193

MANSFIELD, MA
TEL: 508-822-9300
FAX: 508-822-3288

Date Rec'd in Lab: 7/25/17

ALPHA Job #: L1725482

Client Information

Client: BLUELEAF INC

Address: 57 DRESSER HILL RD
CHARLTON MA 01507

Phone: 508-248-7094

Fax:

Email: egrotton@blueleafwater.com

☐ These samples have been previously analyzed by Alpha

Project Information

Project Name: BARNSTABLE

Project Location: MAINE

Project #: 20107

Project Manager: ERIK GROTTON

ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)

Date Due: Time:

Report Information - Data Deliverables

☐ FAX ☐ EMAIL

☒ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State /Fed Program | Criteria

Other Project Specific Requirements/Comments/Detection Limits:

PLEASE NOTE
MS/MSD (at unit cost) will be omitted unless you check here: ☐

SAMPLE HANDLING

Filtration ________
☐ Done
☐ Not needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Fe, Mn	TURB: D:T Y, DA, AIK	TURB: D:T Y, AIK	1-4 Dioxane	PFOC, PFOA	Sample Specific Comments	TOTAL # BOTTLES
25482-01	RAW-2	7/25	11:00AM	W	BJS	1	1		1	1		4
02	FILTER A-2	↓	↓	↓	↓	1		1				2
03	FILTER C-2	↓	↓	↓	↓	1		1				2
04	FILTER E-2	↓	↓	↓	↓				1	1		2
05	FILTER F-2	↓	↓	↓	↓				1	1		2
06	UV-2	↓	↓	↓	↓				1	1		2

Container Type	P
Preservative	C

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	7/25/17 13:00	[signature] AAL	7/25/17 13:00

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 101-09 (rev. 27-SEP-10)

ANALYTICAL REPORT

Lab Number:	L1726662
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Erik Grotton
Phone:	(508) 248-7094
Project Name:	MAHER WELLS
Project Number:	20107
Report Date:	08/08/17

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1726662
Report Date: 08/08/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1726662-01	FILTER A CBW	DW	BARNSTABLE, MA	07/28/17 09:30	08/02/17
L1726662-02	FILTER A SSN	DW	BARNSTABLE, MA	07/31/17 10:20	08/02/17
L1726662-03	FILTER C CBW	DW	BARNSTABLE, MA	07/28/17 09:30	08/02/17
L1726662-04	FILTER C SSN	DW	BARNSTABLE, MA	07/31/17 10:20	08/02/17

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1726662
Report Date: 08/08/17

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. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated 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.

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 table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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 Client Service Representative 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 Client Services at 800-624-9220 with any questions.

Project Name:	MAHER WELLS	**Lab Number:**	L1726662
Project Number:	20107	**Report Date:**	08/08/17

Case Narrative (continued)

Chlorine, Total Residual

L1726662-01 through -04 were analyzed with the method required holding time exceeded.

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: Amita Naik

Title: Technical Director/Representative Date: 08/08/17

METALS

Project Name: MAHER WELLS
Lab Number: L1726662
Project Number: 20107
Report Date: 08/08/17

SAMPLE RESULTS

Lab ID: L1726662-01
Client ID: FILTER A CBW
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 07/28/17 09:30
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	7.10		mg/l	0.050	--	1	08/03/17 16:11	08/04/17 15:20	EPA 3005A	19,200.7	PS
Manganese, Total	3.32		mg/l	0.010	--	1	08/03/17 16:11	08/04/17 15:20	EPA 3005A	19,200.7	PS

Project Name: MAHER WELLS
Lab Number: L1726662
Project Number: 20107
Report Date: 08/08/17

SAMPLE RESULTS

Lab ID: L1726662-02
Client ID: FILTER A SSN
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 07/31/17 10:20
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.173		mg/l	0.050	--	1	08/03/17 16:11	08/04/17 15:24	EPA 3005A	19,200.7	PS
Manganese, Total	0.099		mg/l	0.010	--	1	08/03/17 16:11	08/04/17 15:24	EPA 3005A	19,200.7	PS

Project Name: MAHER WELLS
Lab Number: L1726662
Project Number: 20107
Report Date: 08/08/17

SAMPLE RESULTS

Lab ID: L1726662-03
Client ID: FILTER C CBW
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 07/28/17 09:30
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	8.20		mg/l	0.050	--	1	08/03/17 16:11	08/04/17 15:28	EPA 3005A	19,200.7	PS
Manganese, Total	3.74		mg/l	0.010	--	1	08/03/17 16:11	08/04/17 15:28	EPA 3005A	19,200.7	PS

Project Name: MAHER WELLS
Lab Number: L1726662
Project Number: 20107
Report Date: 08/08/17

SAMPLE RESULTS

Lab ID: L1726662-04
Client ID: FILTER C SSN
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 07/31/17 10:20
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.080		mg/l	0.050	--	1	08/03/17 16:11	08/04/17 15:32	EPA 3005A	19,200.7	PS
Manganese, Total	0.137		mg/l	0.010	--	1	08/03/17 16:11	08/04/17 15:32	EPA 3005A	19,200.7	PS

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1726662
Report Date: 08/08/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-04 Batch: WG1028642-1										
Iron, Total	ND		mg/l	0.050	--	1	08/03/17 16:11	08/04/17 14:17	19,200.7	PS
Manganese, Total	ND		mg/l	0.010	--	1	08/03/17 16:11	08/04/17 14:17	19,200.7	PS

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELLS

Project Number: 20107

Lab Number: L1726662

Report Date: 08/08/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 Batch: WG1028642-2								
Iron, Total	110		-		85-115	-		
Manganese, Total	100		-		85-115	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1726662
Report Date: 08/08/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1028642-3 QC Sample: L1726569-01 Client ID: MS Sample												
Iron, Total	16.6	1	17.6	100		-	-		75-125	-		20
Manganese, Total	1.58	0.5	2.06	96		-	-		75-125	-		20
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1028642-7 QC Sample: L1726739-01 Client ID: MS Sample												
Iron, Total	0.215	1	1.30	108		-	-		75-125	-		20
Manganese, Total	0.057	0.5	0.535	96		-	-		75-125	-		20

INORGANICS
&
MISCELLANEOUS

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1726662
Report Date: 08/08/17

SAMPLE RESULTS

Lab ID: L1726662-01
Client ID: FILTER A CBW
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 07/28/17 09:30
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total Suspended	32.		mg/l	10	NA	2	-	08/03/17 05:50	121,2540D	VB
Chlorine, Total Residual	0.36		mg/l	0.02	--	1	-	08/02/17 22:52	121,4500CL-D	AS

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1726662
Report Date: 08/08/17

SAMPLE RESULTS

Lab ID: L1726662-02
Client ID: FILTER A SSN
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 07/31/17 10:20
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total Suspended	ND		mg/l	5.0	NA	1	-	08/03/17 05:50	121,2540D	VB
Chlorine, Total Residual	ND		mg/l	0.02	--	1	-	08/02/17 22:52	121,4500CL-D	AS

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1726662
Report Date: 08/08/17

SAMPLE RESULTS

Lab ID: L1726662-03
Client ID: FILTER C CBW
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 07/28/17 09:30
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total Suspended	78.		mg/l	10	NA	2	-	08/03/17 05:50	121,2540D	VB
Chlorine, Total Residual	ND		mg/l	0.02	--	1	-	08/02/17 22:52	121,4500CL-D	AS

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1726662
Report Date: 08/08/17

SAMPLE RESULTS

Lab ID: L1726662-04
Client ID: FILTER C SSN
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 07/31/17 10:20
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total Suspended	ND		mg/l	5.0	NA	1	-	08/03/17 05:50	121,2540D	VB
Chlorine, Total Residual	ND		mg/l	0.02	--	1	-	08/02/17 22:52	121,4500CL-D	AS

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1726662
Report Date: 08/08/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG1028281-1										
Chlorine, Total Residual	ND		mg/l	0.02	--	1	-	08/02/17 22:52	121,4500CL-D	AS
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG1028365-1										
Solids, Total Suspended	ND		mg/l	5.0	NA	1	-	08/03/17 05:50	121,2540D	VB

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELLS

Project Number: 20107

Lab Number: L1726662

Report Date: 08/08/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG1028281-2								
Chlorine, Total Residual	93		-		90-110	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1726662
Report Date: 08/08/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1028281-4 QC Sample: L1726725-02 Client ID: MS Sample												
Chlorine, Total Residual	ND	0.248	ND	**0**	Q	-	-		80-120	-		20

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1726662
Report Date: 08/08/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1028281-3 QC Sample: L1726725-01 Client ID: DUP Sample						
Chlorine, Total Residual	ND	ND	mg/l	NC		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1028365-2 QC Sample: L1726662-03 Client ID: FILTER C CBW						
Solids, Total Suspended	78	73	mg/l	7		29

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1726662
Report Date: 08/08/17

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(*)
L1726662-01A	Plastic 120ml HNO3 preserved	A	<2	<2	5.6	Y	Absent		FE-UI(180),MN-UI(180)
L1726662-01B	Plastic 250ml unpreserved	A	7	7	5.6	Y	Absent		TRC-4500(1)
L1726662-01C	Plastic 950ml unpreserved	A	7	7	5.6	Y	Absent		TSS-2540(7)
L1726662-02A	Plastic 120ml HNO3 preserved	A	<2	<2	5.6	Y	Absent		FE-UI(180),MN-UI(180)
L1726662-02B	Plastic 250ml unpreserved	A	7	7	5.6	Y	Absent		TRC-4500(1)
L1726662-02C	Plastic 950ml unpreserved	A	7	7	5.6	Y	Absent		TSS-2540(7)
L1726662-03A	Plastic 120ml HNO3 preserved	A	<2	<2	5.6	Y	Absent		FE-UI(180),MN-UI(180)
L1726662-03B	Plastic 250ml unpreserved	A	7	7	5.6	Y	Absent		TRC-4500(1)
L1726662-03C	Plastic 950ml unpreserved	A	7	7	5.6	Y	Absent		TSS-2540(7)
L1726662-04A	Plastic 120ml HNO3 preserved	A	<2	<2	5.6	Y	Absent		FE-UI(180),MN-UI(180)
L1726662-04B	Plastic 250ml unpreserved	A	7	7	5.6	Y	Absent		TRC-4500(1)
L1726662-04C	Plastic 950ml unpreserved	A	7	7	5.6	Y	Absent		TSS-2540(7)

*Values in parentheses indicate holding time in days

Project Name:	MAHER WELLS	**Lab Number:**	L1726662
Project Number:	20107	**Report Date:**	08/08/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	MAHER WELLS	**Lab Number:**	L1726662
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Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name:	MAHER WELLS	**Lab Number:**	L1726662
Project Number:	20107	**Report Date:**	08/08/17

REFERENCES

19 Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 8/2/17

ALPHA Job #: L1726662

ALPHA ANALYTICAL
World Class Chemistry
8 Walkup Drive, Westboro, MA 01581, Tel: 508-898-9220
320 Forbes Blvd, Mansfield, MA 02048, Tel: 508-822-9300

Client Information

Client: BLUELEAF INC
Address: 57 DRESSER HILL RD
CHARLTON MA 01507
Phone: 508 248 7094
Email: egrotton@blueleafinc.com

Project Information

Project Name: MAITER WELLS
Project Location: BARNSTABLE MA
Project #: 20107
Project Manager: ERIK GROTTON
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)
Date Due:

Additional Project Information:

Report Information - Data Deliverables

☒ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☒ No MA MCP Analytical Methods ☐ Yes ☒ No CT RCP Analytical Methods
☐ Yes ☒ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☒ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☒ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

ANALYSIS

VOC: ☐ 8260 ☐ 624 ☐ 524.2
SVOC: ☐ ABN ☐ PAH
METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15
METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13
EPH: ☐ Ranges & Targets ☐ Ranges Only
VPH: ☐ Ranges & Targets ☐ Ranges Only
☐ PCB ☐ PEST
TPH: ☐ Quant Only ☐ Fingerprint
FE, Mn (TOTAL)
TSS
CHLORIDE
RES. Dual (CT)

SAMPLE INFO
Filtration
☐ Field
☐ Lab to do
Preservation
☐ Lab to do

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	Sample Comments	TOTAL # BOTTLES
26662-01	FILTER A CBW	7/28	9:30	DW	BJS		3
-02	FILTER A SSW	7/31	10:20	DW	CAW		3
-03	FILTER C CBW	7/28	9:30	DW	BJS		3
-04	FILTER C SSW	7/31	10:20	DW	CAW		3

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

	Container Type	Preservative

Relinquished By:	Date/Time	Received By:	Date/Time
	8/2/17 1403		8/2/17 14:03

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

ANALYTICAL REPORT

Lab Number:	L1726666
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Erik Grotton
Phone:	(508) 248-7094
Project Name:	MAHER WELL PILOT
Project Number:	20107
Report Date:	08/23/17

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1726666
Report Date: 08/23/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1726666-01	RAW-1	DW	BARNSTABLE, MA	08/02/17 09:00	08/02/17
L1726666-02	FILTER A-1	DW	BARNSTABLE, MA	08/02/17 09:00	08/02/17
L1726666-03	FILTER B-1	DW	BARNSTABLE, MA	08/02/17 09:00	08/02/17
L1726666-04	FILTER C-1	DW	BARNSTABLE, MA	08/02/17 09:00	08/02/17
L1726666-05	FILTER D-1	DW	BARNSTABLE, MA	08/02/17 09:00	08/02/17
L1726666-06	FILTER B-1	DW	BARNSTABLE, MA	08/02/17 09:00	08/02/17
L1726666-07	FILTER D-1	DW	BARNSTABLE, MA	08/02/17 09:00	08/02/17
L1726666-08	FILTER B-1 (DAY 7)	WATER	BARNSTABLE, MA	08/02/17 09:00	08/02/17
L1726666-09	FILTER D-1 (DAY 7)	WATER	BARNSTABLE, MA	08/02/17 09:00	08/02/17

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

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. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated 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.

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 table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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 Client Service Representative 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 Client Services at 800-624-9220 with any questions.

Project Name: MAHER WELL PILOT **Lab Number:** L1726666
Project Number: 20107 **Report Date:** 08/23/17

Case Narrative (continued)

Report Submission

The analyses of Bromate and Haloacetic Acids were subcontracted. Copies of the laboratory reports are included as an addendum. Please note: This data is only available in PDF format and is not available on Data Merger.

Volatile Organics by Method 524

WG1030986: A Matrix Spike and Laboratory Duplicate were prepared with the sample batch, however, the native sample was canceled; therefore, the Matrix Spike and Laboratory Duplicate results could not be reported.

Total Metals

The WG1030338-2 LCS recovery, associated with L1726666-02 through -05, is above the acceptance criteria for aluminum (118%); however, the associated samples are non-detect to the RL for this target analyte. The results of the original analysis are reported.

Chlorine, Total Residual

The WG1030455-4 MS recovery (52%), performed on L1726666-07, is outside the acceptance criteria; however, the associated LCS recovery is within criteria. No further action was taken.

Anions by Ion Chromatography

The WG1029082-3 MS recovery, performed on L1726666-01, is outside the acceptance criteria for chloride (83%); however, the associated LCS recovery is within criteria. No further action was taken.

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: Kara Lindquist

Title: Technical Director/Representative Date: 08/23/17

ORGANICS

VOLATILES

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1726666-01
Client ID: RAW-1
Sample Location: BARNSTABLE, MA

Date Collected: 08/02/17 09:00
Date Received: 08/02/17
Field Prep: Not Specified

Matrix: Dw
Analytical Method: 16,524.2
Analytical Date: 08/10/17 17:30
Analyst: MM

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Organics by GC/MS - Westborough Lab						
Methyl tert butyl ether	ND		ug/l	0.50	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichlorobenzene-d4	105		80-120
4-Bromofluorobenzene	95		80-120

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1726666-08
Client ID: FILTER B-1 (DAY 7)
Sample Location: BARNSTABLE, MA

Date Collected: 08/02/17 09:00
Date Received: 08/02/17
Field Prep: Not Specified

Matrix: Water
Analytical Method: 16,524.2
Analytical Date: 08/11/17 16:08
Analyst: GT

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Organics by GC/MS - Westborough Lab						
Chloroform	ND		ug/l	0.50	--	1
Bromodichloromethane	1.4		ug/l	0.50	--	1
Dibromochloromethane	2.4		ug/l	0.50	--	1
Bromoform	1.2		ug/l	0.50	--	1
THMs, Total	5.0		ug/l	0.50	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichlorobenzene-d4	105		80-120
4-Bromofluorobenzene	95		80-120

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1726666-09
Client ID: FILTER D-1 (DAY 7)
Sample Location: BARNSTABLE, MA

Date Collected: 08/02/17 09:00
Date Received: 08/02/17
Field Prep: Not Specified

Matrix: Water
Analytical Method: 16,524.2
Analytical Date: 08/11/17 14:57
Analyst: GT

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Organics by GC/MS - Westborough Lab						
Chloroform	ND		ug/l	0.50	--	1
Bromodichloromethane	0.86		ug/l	0.50	--	1
Dibromochloromethane	2.2		ug/l	0.50	--	1
Bromoform	1.5		ug/l	0.50	--	1
THMs, Total	4.6		ug/l	0.50	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichlorobenzene-d4	104		80-120
4-Bromofluorobenzene	93		80-120

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 16,524.2
Analytical Date: 08/11/17 07:14
Analyst: GT

Parameter	Result	Qualifier	Units	RL	MDL
Volatile Organics by GC/MS - Westborough Lab for sample(s): 08-09 Batch: WG1030986-10					
Methyl tert butyl ether	ND		ug/l	0.50	--
Chloroform	ND		ug/l	0.50	--
Bromodichloromethane	ND		ug/l	0.50	--
Dibromochloromethane	ND		ug/l	0.50	--
Bromoform	ND		ug/l	0.50	--
THMs, Total	ND		ug/l	0.50	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichlorobenzene-d4	102		80-120
4-Bromofluorobenzene	94		80-120

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 16,524.2
Analytical Date: 08/10/17 11:35
Analyst: BD

Parameter	Result	Qualifier	Units	RL	MDL
Volatile Organics by GC/MS - Westborough Lab for sample(s): 01 Batch: WG1030986-4					
Methyl tert butyl ether	ND		ug/l	0.50	--
Chloroform	ND		ug/l	0.50	--
Bromodichloromethane	ND		ug/l	0.50	--
Dibromochloromethane	ND		ug/l	0.50	--
Bromoform	ND		ug/l	0.50	--
THMs, Total	ND		ug/l	0.50	--
Tentatively Identified Compounds					
No Tentatively Identified Compounds	ND		ug/l		

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichlorobenzene-d4	96		80-120
4-Bromofluorobenzene	93		80-120

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1726666

Report Date: 08/23/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Volatile Organics by GC/MS - Westborough Lab Associated sample(s): 01 Batch: WG1030986-3								
Methyl tert butyl ether	98		-		70-130	-		20
Chloroform	105		-		70-130	-		20
Bromodichloromethane	108		-		70-130	-		20
Dibromochloromethane	105		-		70-130	-		20
Bromoform	102		-		70-130	-		20

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichlorobenzene-d4	96				80-120
4-Bromofluorobenzene	99				80-120

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1726666

Report Date: 08/23/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Volatile Organics by GC/MS - Westborough Lab Associated sample(s): 08-09 Batch: WG1030986-9								
Methyl tert butyl ether	95		-		70-130	-		20
Chloroform	102		-		70-130	-		20
Bromodichloromethane	98		-		70-130	-		20
Dibromochloromethane	95		-		70-130	-		20
Bromoform	90		-		70-130	-		20

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichlorobenzene-d4	100				80-120
4-Bromofluorobenzene	99				80-120

METALS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1726666-01
Client ID: RAW-1
Sample Location: BARNSTABLE, MA
Matrix: Dw
Date Collected: 08/02/17 09:00
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	ND		mg/l	0.100	--	1	08/03/17 10:00	08/08/17 19:46	EPA 3005A	19,200.7	AB
Antimony, Total	ND		mg/l	0.0040	--	1	08/03/17 10:00	08/04/17 14:22	EPA 3005A	3,200.8	BV
Arsenic, Total	ND		mg/l	0.0010	--	1	08/03/17 10:00	08/04/17 14:22	EPA 3005A	3,200.8	BV
Barium, Total	0.0102		mg/l	0.0010	--	1	08/03/17 10:00	08/04/17 14:22	EPA 3005A	3,200.8	BV
Beryllium, Total	ND		mg/l	0.0010	--	1	08/03/17 10:00	08/04/17 14:22	EPA 3005A	3,200.8	BV
Cadmium, Total	ND		mg/l	0.0002	--	1	08/03/17 10:00	08/04/17 14:22	EPA 3005A	3,200.8	BV
Calcium, Total	4.86		mg/l	0.100	--	1	08/03/17 10:00	08/08/17 19:46	EPA 3005A	19,200.7	AB
Chromium, Total	ND		mg/l	0.0030	--	1	08/03/17 10:00	08/04/17 14:22	EPA 3005A	3,200.8	BV
Copper, Total	ND		mg/l	0.010	--	1	08/03/17 10:00	08/08/17 19:46	EPA 3005A	19,200.7	AB
Iron, Total	0.060		mg/l	0.050	--	1	08/03/17 10:00	08/08/17 19:46	EPA 3005A	19,200.7	AB
Magnesium, Total	2.76		mg/l	0.100	--	1	08/03/17 10:00	08/08/17 19:46	EPA 3005A	19,200.7	AB
Manganese, Total	0.042		mg/l	0.010	--	1	08/03/17 10:00	08/08/17 19:46	EPA 3005A	19,200.7	AB
Mercury, Total	ND		mg/l	0.0002	--	1	08/03/17 11:38	08/03/17 15:24	EPA 245.1	3,245.1	MG
Nickel, Total	ND		mg/l	0.0020	--	1	08/03/17 10:00	08/04/17 14:22	EPA 3005A	3,200.8	BV
Potassium, Total	ND		mg/l	2.50	--	1	08/03/17 10:00	08/08/17 19:46	EPA 3005A	19,200.7	AB
Selenium, Total	ND		mg/l	0.0050	--	1	08/03/17 10:00	08/04/17 14:22	EPA 3005A	3,200.8	BV
Silver, Total	ND		mg/l	0.007	--	1	08/03/17 10:00	08/08/17 19:46	EPA 3005A	19,200.7	AB
Sodium, Total	13.9		mg/l	2.00	--	1	08/03/17 10:00	08/08/17 19:46	EPA 3005A	19,200.7	AB
Thallium, Total	ND		mg/l	0.0010	--	1	08/03/17 10:00	08/04/17 14:22	EPA 3005A	3,200.8	BV
Zinc, Total	ND		mg/l	0.050	--	1	08/03/17 10:00	08/08/17 19:46	EPA 3005A	19,200.7	AB
Total Hardness by SM 2340B - Mansfield Lab											
Hardness	23.5		mg/l	0.660	NA	1	08/03/17 10:00	08/08/17 19:46	EPA 3005A	19,200.7	AB
Dissolved Metals - Mansfield Lab											
Iron, Dissolved	ND		mg/l	0.050	--	1	08/04/17 14:30	08/08/17 14:21	EPA 3005A	19,200.7	PS
Manganese, Dissolved	0.043		mg/l	0.010	--	1	08/04/17 14:30	08/08/17 14:21	EPA 3005A	19,200.7	PS

Project Name: MAHER WELL PILOT
Lab Number: L1726666
Project Number: 20107
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1726666-02
Client ID: FILTER A-1
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/02/17 09:00
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	ND		mg/l	0.100	--	1	08/09/17 12:10	08/09/17 19:49	EPA 3005A	19,200.7	PS
Calcium, Total	4.56		mg/l	0.100	--	1	08/09/17 12:10	08/09/17 19:49	EPA 3005A	19,200.7	PS
Copper, Total	ND		mg/l	0.010	--	1	08/09/17 12:10	08/09/17 19:49	EPA 3005A	19,200.7	PS
Iron, Total	ND		mg/l	0.050	--	1	08/09/17 12:10	08/09/17 19:49	EPA 3005A	19,200.7	PS
Manganese, Total	ND		mg/l	0.010	--	1	08/09/17 12:10	08/09/17 19:49	EPA 3005A	19,200.7	PS
Sodium, Total	13.8		mg/l	2.00	--	1	08/09/17 12:10	08/09/17 19:49	EPA 3005A	19,200.7	PS
Total Hardness by SM 2340B - Mansfield Lab											
Hardness	22.0		mg/l	0.660	NA	1	08/09/17 12:10	08/09/17 19:49	EPA 3005A	19,200.7	PS

Project Name: MAHER WELL PILOT
Lab Number: L1726666
Project Number: 20107
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1726666-03
Client ID: FILTER B-1
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/02/17 09:00
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	ND		mg/l	0.100	--	1	08/09/17 12:10	08/09/17 19:53	EPA 3005A	19,200.7	PS
Calcium, Total	4.49		mg/l	0.100	--	1	08/09/17 12:10	08/09/17 19:53	EPA 3005A	19,200.7	PS
Copper, Total	ND		mg/l	0.010	--	1	08/09/17 12:10	08/09/17 19:53	EPA 3005A	19,200.7	PS
Iron, Total	ND		mg/l	0.050	--	1	08/09/17 12:10	08/09/17 19:53	EPA 3005A	19,200.7	PS
Manganese, Total	ND		mg/l	0.010	--	1	08/09/17 12:10	08/09/17 19:53	EPA 3005A	19,200.7	PS
Sodium, Total	13.5		mg/l	2.00	--	1	08/09/17 12:10	08/09/17 19:53	EPA 3005A	19,200.7	PS
Total Hardness by SM 2340B - Mansfield Lab											
Hardness	21.6		mg/l	0.660	NA	1	08/09/17 12:10	08/09/17 19:53	EPA 3005A	19,200.7	PS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1726666-04
Client ID: FILTER C-1
Sample Location: BARNSTABLE, MA
Matrix: Dw
Date Collected: 08/02/17 09:00
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	ND		mg/l	0.100	--	1	08/09/17 12:10	08/09/17 19:57	EPA 3005A	19,200.7	PS
Calcium, Total	4.60		mg/l	0.100	--	1	08/09/17 12:10	08/09/17 19:57	EPA 3005A	19,200.7	PS
Copper, Total	ND		mg/l	0.010	--	1	08/09/17 12:10	08/09/17 19:57	EPA 3005A	19,200.7	PS
Iron, Total	ND		mg/l	0.050	--	1	08/09/17 12:10	08/09/17 19:57	EPA 3005A	19,200.7	PS
Manganese, Total	ND		mg/l	0.010	--	1	08/09/17 12:10	08/09/17 19:57	EPA 3005A	19,200.7	PS
Sodium, Total	13.6		mg/l	2.00	--	1	08/09/17 12:10	08/09/17 19:57	EPA 3005A	19,200.7	PS
Total Hardness by SM 2340B - Mansfield Lab											
Hardness	22.2		mg/l	0.660	NA	1	08/09/17 12:10	08/09/17 19:57	EPA 3005A	19,200.7	PS

Project Name: MAHER WELL PILOT
Lab Number: L1726666
Project Number: 20107
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1726666-05
Client ID: FILTER D-1
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/02/17 09:00
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	ND		mg/l	0.100	--	1	08/09/17 12:10	08/09/17 20:13	EPA 3005A	19,200.7	PS
Calcium, Total	4.52		mg/l	0.100	--	1	08/09/17 12:10	08/09/17 20:13	EPA 3005A	19,200.7	PS
Copper, Total	ND		mg/l	0.010	--	1	08/09/17 12:10	08/09/17 20:13	EPA 3005A	19,200.7	PS
Iron, Total	ND		mg/l	0.050	--	1	08/09/17 12:10	08/09/17 20:13	EPA 3005A	19,200.7	PS
Manganese, Total	ND		mg/l	0.010	--	1	08/09/17 12:10	08/09/17 20:13	EPA 3005A	19,200.7	PS
Sodium, Total	13.4		mg/l	2.00	--	1	08/09/17 12:10	08/09/17 20:13	EPA 3005A	19,200.7	PS
Total Hardness by SM 2340B - Mansfield Lab											
Hardness	22.1		mg/l	0.660	NA	1	08/09/17 12:10	08/09/17 20:13	EPA 3005A	19,200.7	PS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01 Batch: WG1028413-1										
Antimony, Total	ND		mg/l	0.0040	--	1	08/03/17 10:00	08/04/17 13:01	3,200.8	BV
Arsenic, Total	ND		mg/l	0.0010	--	1	08/03/17 10:00	08/04/17 13:01	3,200.8	BV
Barium, Total	ND		mg/l	0.0010	--	1	08/03/17 10:00	08/04/17 13:01	3,200.8	BV
Beryllium, Total	ND		mg/l	0.0010	--	1	08/03/17 10:00	08/04/17 13:01	3,200.8	BV
Cadmium, Total	ND		mg/l	0.0002	--	1	08/03/17 10:00	08/04/17 13:01	3,200.8	BV
Chromium, Total	ND		mg/l	0.0030	--	1	08/03/17 10:00	08/04/17 13:01	3,200.8	BV
Nickel, Total	ND		mg/l	0.00200	--	1	08/03/17 10:00	08/04/17 13:01	3,200.8	BV
Selenium, Total	ND		mg/l	0.0050	--	1	08/03/17 10:00	08/04/17 13:01	3,200.8	BV
Thallium, Total	ND		mg/l	0.0010	--	1	08/03/17 10:00	08/04/17 13:01	3,200.8	BV

Prep Information

Digestion Method: EPA 3005A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01 Batch: WG1028415-1										
Aluminum, Total	ND		mg/l	0.100	--	1	08/03/17 10:00	08/08/17 17:51	19,200.7	AB
Calcium, Total	ND		mg/l	0.100	--	1	08/03/17 10:00	08/08/17 17:51	19,200.7	AB
Copper, Total	ND		mg/l	0.010	--	1	08/03/17 10:00	08/08/17 17:51	19,200.7	AB
Iron, Total	ND		mg/l	0.050	--	1	08/03/17 10:00	08/08/17 17:51	19,200.7	AB
Magnesium, Total	ND		mg/l	0.100	--	1	08/03/17 10:00	08/08/17 17:51	19,200.7	AB
Manganese, Total	ND		mg/l	0.010	--	1	08/03/17 10:00	08/08/17 17:51	19,200.7	AB
Potassium, Total	ND		mg/l	2.50	--	1	08/03/17 10:00	08/08/17 17:51	19,200.7	AB
Silver, Total	ND		mg/l	0.007	--	1	08/03/17 10:00	08/08/17 17:51	19,200.7	AB
Sodium, Total	ND		mg/l	2.00	--	1	08/03/17 10:00	08/08/17 17:51	19,200.7	AB
Zinc, Total	ND		mg/l	0.050	--	1	08/03/17 10:00	08/08/17 17:51	19,200.7	AB

Prep Information

Digestion Method: EPA 3005A

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Hardness by SM 2340B - Mansfield Lab for sample(s): 01 Batch: WG1028415-1										
Hardness	ND		mg/l	0.660	NA	1	08/03/17 10:00	08/08/17 17:51	19,200.7	AB

Prep Information

Digestion Method: EPA 3005A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01 Batch: WG1028518-1										
Mercury, Total	ND		mg/l	0.0002	--	1	08/03/17 11:38	08/03/17 15:01	3,245.1	MG

Prep Information

Digestion Method: EPA 245.1

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Dissolved Metals - Mansfield Lab for sample(s): 01 Batch: WG1029006-1										
Iron, Dissolved	ND		mg/l	0.050	--	1	08/04/17 14:30	08/08/17 13:47	19,200.7	PS
Manganese, Dissolved	ND		mg/l	0.010	--	1	08/04/17 14:30	08/08/17 13:47	19,200.7	PS

Prep Information

Digestion Method: EPA 3005A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 02-05 Batch: WG1030338-1										
Aluminum, Total	ND		mg/l	0.100	--	1	08/09/17 12:10	08/09/17 19:24	19,200.7	PS
Calcium, Total	ND		mg/l	0.100	--	1	08/09/17 12:10	08/09/17 19:24	19,200.7	PS
Copper, Total	ND		mg/l	0.010	--	1	08/09/17 12:10	08/09/17 19:24	19,200.7	PS
Iron, Total	ND		mg/l	0.050	--	1	08/09/17 12:10	08/09/17 19:24	19,200.7	PS
Manganese, Total	ND		mg/l	0.010	--	1	08/09/17 12:10	08/09/17 19:24	19,200.7	PS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

Method Blank Analysis
Batch Quality Control

Sodium, Total	ND	mg/l	2.00	--	1	08/09/17 12:10	08/09/17 19:24	19,200.7	PS

Prep Information

Digestion Method: EPA 3005A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Hardness by SM 2340B - Mansfield Lab for sample(s): 02-05 Batch: WG1030338-1										
Hardness	ND		mg/l	0.660	NA	1	08/09/17 12:10	08/09/17 19:24	19,200.7	PS

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1726666

Report Date: 08/23/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01 Batch: WG1028413-2								
Antimony, Total	111		-		85-115	-		
Arsenic, Total	105		-		85-115	-		
Barium, Total	109		-		85-115	-		
Beryllium, Total	102		-		85-115	-		
Cadmium, Total	108		-		85-115	-		
Chromium, Total	113		-		85-115	-		
Nickel, Total	112		-		85-115	-		
Selenium, Total	109		-		85-115	-		
Thallium, Total	105		-		85-115	-		
Total Metals - Mansfield Lab Associated sample(s): 01 Batch: WG1028415-2								
Aluminum, Total	115		-		85-115	-		
Calcium, Total	94		-		85-115	-		
Copper, Total	103		-		85-115	-		
Iron, Total	112		-		85-115	-		
Magnesium, Total	101		-		85-115	-		
Manganese, Total	106		-		85-115	-		
Potassium, Total	99		-		85-115	-		
Silver, Total	107		-		85-115	-		
Sodium, Total	99		-		85-115	-		
Zinc, Total	111		-		85-115	-		

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1726666

Report Date: 08/23/17

Parameter	LCS %Recovery		LCSD %Recovery	%Recovery Limits	RPD	RPD Limits
Total Hardness by SM 2340B - Mansfield Lab Associated sample(s): 01 Batch: WG1028415-2						
Hardness	98		-	85-115	-	
Total Metals - Mansfield Lab Associated sample(s): 01 Batch: WG1028518-2						
Mercury, Total	108		-	85-115	-	
Dissolved Metals - Mansfield Lab Associated sample(s): 01 Batch: WG1029006-2						
Iron, Dissolved	113		-	85-115	-	
Manganese, Dissolved	105		-	85-115	-	
Total Metals - Mansfield Lab Associated sample(s): 02-05 Batch: WG1030338-2						
Aluminum, Total	**118**	Q	-	85-115	-	
Calcium, Total	99		-	85-115	-	
Copper, Total	108		-	85-115	-	
Iron, Total	112		-	85-115	-	
Manganese, Total	107		-	85-115	-	
Sodium, Total	100		-	85-115	-	
Total Hardness by SM 2340B - Mansfield Lab Associated sample(s): 02-05 Batch: WG1030338-2						
Hardness	99		-	85-115	-	

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1726666
Report Date: 08/23/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG1028413-3 QC Sample: L1726599-01 Client ID: MS Sample												
Antimony, Total	ND	0.5	0.5009	100		-	-		70-130	-		20
Arsenic, Total	ND	0.12	0.1228	102		-	-		70-130	-		20
Barium, Total	0.0984	2	2.010	96		-	-		70-130	-		20
Beryllium, Total	ND	0.05	0.0563	113		-	-		70-130	-		20
Cadmium, Total	ND	0.051	0.0533	104		-	-		70-130	-		20
Chromium, Total	ND	0.2	0.1932	97		-	-		70-130	-		20
Nickel, Total	ND	0.5	0.4752	95		-	-		70-130	-		20
Selenium, Total	ND	0.12	0.1342	112		-	-		70-130	-		20
Thallium, Total	ND	0.12	0.1132	94		-	-		70-130	-		20
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG1028413-5 QC Sample: L1726600-01 Client ID: MS Sample												
Antimony, Total	ND	0.5	0.5478	110		-	-		70-130	-		20
Arsenic, Total	ND	0.12	0.1216	101		-	-		70-130	-		20
Barium, Total	0.0386	2	2.103	103		-	-		70-130	-		20
Beryllium, Total	ND	0.05	0.0585	117		-	-		70-130	-		20
Cadmium, Total	ND	0.051	0.0567	111		-	-		70-130	-		20
Chromium, Total	ND	0.2	0.2106	105		-	-		70-130	-		20
Nickel, Total	0.0027	0.5	0.5248	104		-	-		70-130	-		20
Selenium, Total	ND	0.12	0.1124	94		-	-		70-130	-		20
Thallium, Total	ND	0.12	0.1182	98		-	-		70-130	-		20

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1726666
Report Date: 08/23/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery		MSD Found	MSD %Recovery	Recovery Limits	RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG1028415-3 QC Sample: L1726599-01 Client ID: MS Sample										
Aluminum, Total	ND	2	2.43	122		-	-	75-125	-	20
Calcium, Total	72.3	10	80.6	83		-	-	75-125	-	20
Copper, Total	ND	0.25	0.283	113		-	-	75-125	-	20
Iron, Total	0.114	1	1.23	112		-	-	75-125	-	20
Magnesium, Total	15.6	10	24.9	93		-	-	75-125	-	20
Manganese, Total	0.989	0.5	1.49	100		-	-	75-125	-	20
Potassium, Total	14.5	10	25.0	105		-	-	75-125	-	20
Silver, Total	ND	0.05	0.055	110		-	-	75-125	-	20
Sodium, Total	523	10	515	**0**	Q	-	-	75-125	-	20
Zinc, Total	ND	0.5	0.539	108		-	-	75-125	-	20
Total Hardness by SM 2340B - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG1028415-3 QC Sample: L1726599-01 Client ID: MS Sample										
Hardness	245	66.2	304	89		-	-	75-125	-	20
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG1028518-3 QC Sample: L1726599-01 Client ID: MS Sample										
Mercury, Total	ND	0.005	0.0046	91		-	-	70-130	-	20
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG1028518-5 QC Sample: L1726745-01 Client ID: MS Sample										
Mercury, Total	ND	0.005	0.0049	97		-	-	70-130	-	20
Dissolved Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG1029006-3 QC Sample: L1726916-01 Client ID: MS Sample										
Iron, Dissolved	ND	1	1.13	113		-	-	75-125	-	20
Manganese, Dissolved	ND	0.5	0.524	105		-	-	75-125	-	20

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1726666
Report Date: 08/23/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery		MSD Found	MSD %Recovery	Recovery Limits	RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 02-05 QC Batch ID: WG1030338-3 QC Sample: L1726830-02 Client ID: MS Sample										
Aluminum, Total	ND	2	2.46	123		-	-	75-125	-	20
Calcium, Total	147	10	150	**30**	Q	-	-	75-125	-	20
Copper, Total	ND	0.25	0.287	115		-	-	75-125	-	20
Iron, Total	ND	1	1.14	114		-	-	75-125	-	20
Manganese, Total	0.094	0.5	0.615	104		-	-	75-125	-	20
Sodium, Total	662	10	627	**0**	Q	-	-	75-125	-	20
Total Hardness by SM 2340B - Mansfield Lab Associated sample(s): 02-05 QC Batch ID: WG1030338-3 QC Sample: L1726830-02 Client ID: MS Sample										
Hardness	420	66.2	459	**59**	Q	-	-	75-125	-	20

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1726666
Report Date: 08/23/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG1028413-4 QC Sample: L1726599-01 Client ID: DUP Sample						
Antimony, Total	ND	ND	mg/l	NC		20
Arsenic, Total	ND	ND	mg/l	NC		20
Cadmium, Total	ND	ND	mg/l	NC		20
Chromium, Total	ND	ND	mg/l	NC		20
Nickel, Total	ND	ND	mg/l	NC		20
Selenium, Total	ND	ND	mg/l	NC		20
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG1028415-4 QC Sample: L1726599-01 Client ID: DUP Sample						
Iron, Total	0.114	0.095	mg/l	18		20
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG1028518-4 QC Sample: L1726599-01 Client ID: DUP Sample						
Mercury, Total	ND	ND	mg/l	NC		20
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG1028518-6 QC Sample: L1726745-01 Client ID: DUP Sample						
Mercury, Total	ND	ND	mg/l	NC		20
Total Metals - Mansfield Lab Associated sample(s): 02-05 QC Batch ID: WG1030338-4 QC Sample: L1726830-02 Client ID: DUP Sample						
Iron, Total	ND	ND	mg/l	NC		20

INORGANICS
&
MISCELLANEOUS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1726666-01
Client ID: RAW-1
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/02/17 09:00
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	ND		NTU	0.20	--	1	-	08/02/17 23:39	44,180.1	AS
Odor @ 60 C	NO ODOR		TON	1	--	1	-	08/02/17 20:30	30,2150B	AS
Color, True	ND		A.P.C.U.	5.0	--	1	-	08/02/17 20:40	121,2120B	AS
Color, Apparent	ND		A.P.C.U.	5.0	--	1	-	08/02/17 20:40	121,2120B	AS
Alkalinity, Total	15.0		mg CaCO3/L	2.00	NA	1	-	08/02/17 20:51	121,2320B	MR
Carbon Dioxide	130		mg/l	2.0	--	1	-	08/02/17 20:51	121,4500CO2-D	MR
Solids, Total Dissolved	42.		mg/l	10	--	1	-	08/03/17 13:35	121,2540C	DW
Cyanide, Total	ND		mg/l	0.005	--	1	08/03/17 10:45	08/03/17 14:30	121,4500CN-CE	LK
Fluoride	ND		mg/l	0.20	--	1	08/09/17 16:53	08/09/17 19:30	121,4500F-C	MM
pH (H)	6.4		SU	-	NA	1	-	08/02/17 18:09	121,4500H+-B	AS
Nitrogen, Nitrate	0.25		mg/l	0.10	--	1	-	08/02/17 21:06	44,353.2	MR
Total Organic Carbon	0.510		mg/l	0.500	--	1	-	08/07/17 13:03	121,5310C	AG
Surfactants, MBAS	ND		mg/l	0.050	--	1	08/02/17 18:00	08/02/17 21:44	121,5540C	CW
Bacteria in Water - Westborough Lab										
Coliform, Total	Positive		col/100ml	-	NA	1	-	08/02/17 17:50	121,9223B	AJ
Escherichia Coli	Negative		col/100ml	-	NA	1	-	08/02/17 17:50	121,9223B	AJ
Anions by Ion Chromatography - Westborough Lab										
Chloride	22.0		mg/l	0.500	--	1	-	08/03/17 18:20	44,300.0	AU
Sulfate	10.0		mg/l	1.00	--	1	-	08/03/17 18:20	44,300.0	AU

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1726666-02
Client ID: FILTER A-1
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/02/17 09:00
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	ND		NTU	0.20	--	1	-	08/02/17 23:39	44,180.1	AS
Color, True	ND		A.P.C.U.	5.0	--	1	-	08/02/17 20:40	121,2120B	AS
Color, Apparent	ND		A.P.C.U.	5.0	--	1	-	08/02/17 20:40	121,2120B	AS
Alkalinity, Total	41.1		mg CaCO3/L	2.00	NA	1	-	08/02/17 20:51	121,2320B	MR
Carbon Dioxide	200		mg/l	2.0	--	1	-	08/02/17 20:51	121,4500CO2-D	MR
pH (H)	6.9		SU	-	NA	1	-	08/02/17 18:09	121,4500H+-B	AS
Nitrogen, Nitrate	0.26		mg/l	0.10	--	1	-	08/02/17 21:13	44,353.2	MR
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	08/02/17 17:50	121,9223B	AJ
Escherichia Coli	Negative		col/100ml	-	NA	1	-	08/02/17 17:50	121,9223B	AJ
Anions by Ion Chromatography - Westborough Lab										
Chloride	22.6		mg/l	0.500	--	1	-	08/03/17 18:32	44,300.0	AU
Sulfate	9.56		mg/l	1.00	--	1	-	08/03/17 18:32	44,300.0	AU

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1726666-03
Client ID: FILTER B-1
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/02/17 09:00
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	ND		NTU	0.20	--	1	-	08/02/17 23:39	44,180.1	AS
Color, True	ND		A.P.C.U.	5.0	--	1	-	08/02/17 20:40	121,2120B	AS
Color, Apparent	ND		A.P.C.U.	5.0	--	1	-	08/02/17 20:40	121,2120B	AS
Alkalinity, Total	42.7		mg CaCO3/L	2.00	NA	1	-	08/02/17 20:51	121,2320B	MR
Carbon Dioxide	190		mg/l	2.0	--	1	-	08/02/17 20:51	121,4500CO2-D	MR
pH (H)	6.8		SU	-	NA	1	-	08/02/17 18:09	121,4500H+-B	AS
Nitrogen, Nitrate	0.27		mg/l	0.10	--	1	-	08/02/17 21:15	44,353.2	MR
Total Organic Carbon	0.510		mg/l	0.500	--	1	-	08/07/17 13:03	121,5310C	AG
Dissolved Organic Carbon	ND		mg/l	1.0	--	1	08/03/17 02:00	08/07/17 13:03	121,5310C	AG
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	08/02/17 17:50	121,9223B	AJ
Escherichia Coli	Negative		col/100ml	-	NA	1	-	08/02/17 17:50	121,9223B	AJ
Anions by Ion Chromatography - Westborough Lab										
Chloride	22.6		mg/l	0.500	--	1	-	08/03/17 18:44	44,300.0	AU
Sulfate	9.54		mg/l	1.00	--	1	-	08/03/17 18:44	44,300.0	AU

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1726666-04
Client ID: FILTER C-1
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/02/17 09:00
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	ND		NTU	0.20	--	1	-	08/02/17 23:39	44,180.1	AS
Color, True	ND		A.P.C.U.	5.0	--	1	-	08/02/17 20:40	121,2120B	AS
Color, Apparent	ND		A.P.C.U.	5.0	--	1	-	08/02/17 20:40	121,2120B	AS
Alkalinity, Total	43.2		mg CaCO3/L	2.00	NA	1	-	08/02/17 20:51	121,2320B	MR
Carbon Dioxide	200		mg/l	2.0	--	1	-	08/02/17 20:51	121,4500CO2-D	MR
pH (H)	6.9		SU	-	NA	1	-	08/02/17 18:09	121,4500H+-B	AS
Nitrogen, Nitrate	0.26		mg/l	0.10	--	1	-	08/02/17 21:16	44,353.2	MR
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	08/02/17 17:50	121,9223B	AJ
Escherichia Coli	Negative		col/100ml	-	NA	1	-	08/02/17 17:50	121,9223B	AJ
Anions by Ion Chromatography - Westborough Lab										
Chloride	22.5		mg/l	0.500	--	1	-	08/03/17 18:56	44,300.0	AU
Sulfate	9.54		mg/l	1.00	--	1	-	08/03/17 18:56	44,300.0	AU

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1726666-05
Client ID: FILTER D-1
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/02/17 09:00
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	ND		NTU	0.20	--	1	-	08/02/17 23:39	44,180.1	AS
Color, True	ND		A.P.C.U.	5.0	--	1	-	08/02/17 20:40	121,2120B	AS
Color, Apparent	ND		A.P.C.U.	5.0	--	1	-	08/02/17 20:40	121,2120B	AS
Alkalinity, Total	41.1		mg CaCO3/L	2.00	NA	1	-	08/02/17 20:51	121,2320B	MR
Carbon Dioxide	180		mg/l	2.0	--	1	-	08/02/17 20:51	121,4500CO2-D	MR
pH (H)	6.9		SU	-	NA	1	-	08/02/17 18:09	121,4500H+-B	AS
Nitrogen, Nitrate	0.26		mg/l	0.10	--	1	-	08/02/17 21:17	44,353.2	MR
Total Organic Carbon	0.520		mg/l	0.500	--	1	-	08/07/17 13:03	121,5310C	AG
Dissolved Organic Carbon	ND		mg/l	1.0	--	1	08/03/17 02:00	08/07/17 13:03	121,5310C	AG
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	08/02/17 17:50	121,9223B	AJ
Escherichia Coli	Negative		col/100ml	-	NA	1	-	08/02/17 17:50	121,9223B	AJ
Anions by Ion Chromatography - Westborough Lab										
Chloride	22.5		mg/l	0.500	--	1	-	08/03/17 19:08	44,300.0	AU
Sulfate	9.54		mg/l	1.00	--	1	-	08/03/17 19:08	44,300.0	AU

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1726666-06
Client ID: FILTER B-1
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/02/17 09:00
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Simulated Distribution System - Westborough Lab										
Chlorine Dose	ND		mg Cl2/L	-	--	1	08/02/17 17:30	08/09/17 13:00	8,5710C	JO
Incubation Time	168		hours	-	--	1	08/02/17 17:30	08/09/17 13:00	8,5710C	JO
pH, Initial	6.8		SU	-	--	1	08/02/17 17:30	08/09/17 13:00	8,5710C	JO
pH, Final	7.19		SU	-	--	1	08/02/17 17:30	08/09/17 13:00	8,5710C	JO
Incubation Temp, Initial	20		deg. C	-	--	1	08/02/17 17:30	08/09/17 13:00	8,5710C	JO
Incubation Temp, Final	20		deg. C	-	--	1	08/02/17 17:30	08/09/17 13:00	8,5710C	JO
Residual Chlorine, Initial	N/A		mg/l	.05	--	1	08/02/17 17:30	08/09/17 13:00	8,5710C	JO
Residual Chlorine, Final (as Total)	0.560		mg/l	0.050	--	1	08/02/17 17:30	08/09/17 13:00	8,5710C	JO
Residual Chlorine, Final (as Free)	ND		mg/l	0.050	--	1	08/02/17 17:30	08/09/17 13:00	8,5710C	JO
General Chemistry - Westborough Lab										
Chlorine, Total Residual	0.56		mg/l	0.04	--	2	-	08/09/17 17:21	121,4500CL-D	AS
Chlorine, Residual Free	ND		mg/l	0.05	--	1	-	08/09/17 17:21	121,4500CL-D	AS
pH (H)	7.2		SU	-	NA	1	-	08/09/17 19:56	121,4500H+-B	AS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1726666-07
Client ID: FILTER D-1
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/02/17 09:00
Date Received: 08/02/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Simulated Distribution System - Westborough Lab										
Chlorine Dose	ND		mg Cl2/L	-	--	1	08/02/17 17:30	08/09/17 13:00	8,5710C	JO
Incubation Time	168		hours	-	--	1	08/02/17 17:30	08/09/17 13:00	8,5710C	JO
pH, Initial	6.9		SU	-	--	1	08/02/17 17:30	08/09/17 13:00	8,5710C	JO
pH, Final	7.1		SU	-	--	1	08/02/17 17:30	08/09/17 13:00	8,5710C	JO
Incubation Temp, Initial	20		deg. C	-	--	1	08/02/17 17:30	08/09/17 13:00	8,5710C	JO
Incubation Temp, Final	20		deg. C	-	--	1	08/02/17 17:30	08/09/17 13:00	8,5710C	JO
Residual Chlorine, Initial	N/A		mg/l	.05	--	1	08/02/17 17:30	08/09/17 13:00	8,5710C	JO
Residual Chlorine, Final (as Total)	0.270		mg/l	0.050	--	1	08/02/17 17:30	08/09/17 13:00	8,5710C	JO
Residual Chlorine, Final (as Free)	ND		mg/l	0.050	--	1	08/02/17 17:30	08/09/17 13:00	8,5710C	JO
General Chemistry - Westborough Lab										
Chlorine, Total Residual	0.27		mg/l	0.02	--	1	-	08/09/17 17:21	121,4500CL-D	AS
Chlorine, Residual Free	ND		mg/l	0.05	--	1	-	08/09/17 17:21	121,4500CL-D	AS
pH (H)	7.1		SU	-	NA	1	-	08/09/17 19:56	121,4500H+-B	AS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1726666
Report Date: 08/23/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Bacteria in Water - Westborough Lab for sample(s): 01-05 Batch: WG1028244-1										
Coliform, Total	Negative		col/100ml	-	NA	1	-	08/02/17 17:50	121,9223B	AJ
Escherichia Coli	Negative		col/100ml	-	NA	1	-	08/02/17 17:50	121,9223B	AJ
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1028252-1										
Odor	NO ODOR		TON	1	--	1	-	08/02/17 20:30	30,2150B	AS
General Chemistry - Westborough Lab for sample(s): 01-05 Batch: WG1028253-1										
Nitrogen, Nitrate	ND		mg/l	0.10	--	1	-	08/02/17 20:48	44,353.2	MR
General Chemistry - Westborough Lab for sample(s): 01-05 Batch: WG1028277-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	08/02/17 20:51	121,2320B	MR
General Chemistry - Westborough Lab for sample(s): 01-05 Batch: WG1028289-1										
Turbidity	ND		NTU	0.20	--	1	-	08/02/17 23:39	44,180.1	AS
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1028299-1										
Surfactants, MBAS	ND		mg/l	0.050	--	1	08/02/17 18:00	08/02/17 21:39	121,5540C	CW
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1028387-1										
Solids, Total Dissolved	ND		mg/l	10	--	1	-	08/03/17 13:35	121,2540C	DW
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1028503-1										
Cyanide, Total	ND		mg/l	0.005	--	1	08/03/17 10:45	08/03/17 14:16	121,4500CN-CE	LK
Anions by Ion Chromatography - Westborough Lab for sample(s): 01-05 Batch: WG1029082-1										
Chloride	ND		mg/l	0.500	--	1	-	08/03/17 17:56	44,300.0	AU
Sulfate	ND		mg/l	1.00	--	1	-	08/03/17 17:56	44,300.0	AU
General Chemistry - Westborough Lab for sample(s): 01,03,05 Batch: WG1029445-1										
Total Organic Carbon	ND		mg/l	0.500	--	1	-	08/07/17 13:03	121,5310C	AG
General Chemistry - Westborough Lab for sample(s): 03,05 Batch: WG1029602-1										
Dissolved Organic Carbon	ND		mg/l	1.0	--	1	08/03/17 02:00	08/07/17 13:03	121,5310C	AG
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1030446-1										
Fluoride	ND		mg/l	0.20	--	1	08/09/17 16:53	08/09/17 19:30	121,4500F-C	MM
General Chemistry - Westborough Lab for sample(s): 06-07 Batch: WG1030455-1										
Chlorine, Total Residual	ND		mg/l	0.02	--	1	-	08/09/17 17:21	121,4500CL-D	AS
General Chemistry - Westborough Lab for sample(s): 06-07 Batch: WG1030456-1										
Chlorine, Residual Free	ND		mg/l	0.05	--	1	-	08/09/17 17:21	121,4500CL-D	AS

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1726666

Report Date: 08/23/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-05 Batch: WG1028243-1								
pH	100		-		99-101	-		5
General Chemistry - Westborough Lab Associated sample(s): 01-05 Batch: WG1028253-2								
Nitrogen, Nitrate	100		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01-05 Batch: WG1028277-2								
Alkalinity, Total	106		-		90-110	-		10
General Chemistry - Westborough Lab Associated sample(s): 01-05 Batch: WG1028289-2								
Turbidity	94		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1028299-2								
Surfactants, MBAS	100		-		65-126	-		
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1028387-2								
Solids, Total Dissolved	108		-		80-120	-		
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1028503-2								
Cyanide, Total	90		-		90-110	-		

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1726666

Report Date: 08/23/17

Parameter	LCS %Recovery	LCSD %Recovery	%Recovery Limits	RPD	RPD Limits
Anions by Ion Chromatography - Westborough Lab Associated sample(s): 01-05 Batch: WG1029082-2					
Chloride	102	-	90-110	-	
Sulfate	103	-	90-110	-	
General Chemistry - Westborough Lab Associated sample(s): 01,03,05 Batch: WG1029445-2					
Total Organic Carbon	97	-	90-110	-	
General Chemistry - Westborough Lab Associated sample(s): 03,05 Batch: WG1029602-2					
Dissolved Organic Carbon	97	-	90-110	-	
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1030446-2					
Fluoride	93	-	78-115	-	
General Chemistry - Westborough Lab Associated sample(s): 06-07 Batch: WG1030455-2					
Chlorine, Total Residual	109	-	90-110	-	
General Chemistry - Westborough Lab Associated sample(s): 06-07 Batch: WG1030456-2					
Chlorine, Residual Free	105	-		-	
General Chemistry - Westborough Lab Associated sample(s): 06-07 Batch: WG1030501-1					
pH	100	-	99-101	-	5

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1726666
Report Date: 08/23/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1028253-4 QC Sample: L1726666-01 Client ID: RAW-1												
Nitrogen, Nitrate	0.25	4	4.2	99		-	-		83-113	-		6
General Chemistry - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1028277-4 QC Sample: L1726666-01 Client ID: RAW-1												
Alkalinity, Total	15.0	100	114	99		-	-		86-116	-		10
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1028299-4 QC Sample: L1726521-06 Client ID: MS Sample												
Surfactants, MBAS	0.140	0.4	0.440	75		-	-		52-157	-		32
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1028503-4 QC Sample: L1726676-01 Client ID: MS Sample												
Cyanide, Total	0.034	0.2	0.226	96		-	-		90-110	-		30
Anions by Ion Chromatography - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1029082-3 QC Sample: L1726666-01 Client ID: RAW-1												
Chloride	22.0	4	25.3	**83**	Q	-	-		90-110	-		18
Sulfate	10.0	8	18.0	100		-	-		90-110	-		20
General Chemistry - Westborough Lab Associated sample(s): 01,03,05 QC Batch ID: WG1029445-4 QC Sample: L1726601-01 Client ID: MS Sample												
Total Organic Carbon	7.31	8	14.9	95		-	-		80-120	-		20
General Chemistry - Westborough Lab Associated sample(s): 03,05 QC Batch ID: WG1029602-4 QC Sample: L1726666-05 Client ID: FILTER D-1												
Dissolved Organic Carbon	ND	4	4.8	119		-	-		80-120	-		20
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1030446-4 QC Sample: L1726666-01 Client ID: RAW-1												
Fluoride	ND	1	1.0	102		-	-		69-124	-		13
General Chemistry - Westborough Lab Associated sample(s): 06-07 QC Batch ID: WG1030455-4 QC Sample: L1726666-07 Client ID: FILTER D-1												
Chlorine, Total Residual	0.27	0.248	0.40	**52**	Q	-	-		80-120	-		20

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1726666
Report Date: 08/23/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1028243-2 QC Sample: L1726666-05 Client ID: FILTER D-1						
pH (H)	6.9	6.9	SU	0		5
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1028252-2 QC Sample: L1726666-01 Client ID: RAW-1						
Odor	NO ODOR	NO ODOR	TON	NC		
General Chemistry - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1028253-3 QC Sample: L1726666-01 Client ID: RAW-1						
Nitrogen, Nitrate	0.25	0.26	mg/l	4		6
General Chemistry - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1028275-1 QC Sample: L1726666-01 Client ID: RAW-1						
Carbon Dioxide	130	120	mg/l	8		
General Chemistry - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1028277-3 QC Sample: L1726666-01 Client ID: RAW-1						
Alkalinity, Total	15.0	15.1	mg CaCO3/L	1		10
General Chemistry - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1028287-2 QC Sample: L1726666-05 Client ID: FILTER D-1						
Color, Apparent	ND	ND	A.P.C.U.	NC		
General Chemistry - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1028288-1 QC Sample: L1726666-05 Client ID: FILTER D-1						
Color, True	ND	ND	A.P.C.U.	NC		
General Chemistry - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1028289-3 QC Sample: L1726739-01 Client ID: DUP Sample						
Turbidity	1.7	1.6	NTU	6		13
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1028299-3 QC Sample: L1726521-06 Client ID: DUP Sample						
Surfactants, MBAS	0.140	0.160	mg/l	13		32

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1726666
Report Date: 08/23/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1028387-3 QC Sample: L1726721-01 Client ID: DUP Sample					
Solids, Total Dissolved	89000	90000	mg/l	1	10
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1028503-3 QC Sample: L1726666-01 Client ID: RAW-1					
Cyanide, Total	ND	ND	mg/l	NC	30
Anions by Ion Chromatography - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1029082-4 QC Sample: L1726666-01 Client ID: RAW-1					
Chloride	22.0	22.0	mg/l	0	18
Sulfate	10.0	9.69	mg/l	3	20
General Chemistry - Westborough Lab Associated sample(s): 01,03,05 QC Batch ID: WG1029445-3 QC Sample: L1726601-01 Client ID: DUP Sample					
Total Organic Carbon	7.31	7.17	mg/l	2	20
General Chemistry - Westborough Lab Associated sample(s): 03,05 QC Batch ID: WG1029602-3 QC Sample: L1726666-03 Client ID: FILTER B-1					
Dissolved Organic Carbon	ND	ND	mg/l	NC	20
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1030446-3 QC Sample: L1726666-01 Client ID: RAW-1					
Fluoride	ND	ND	mg/l	NC	13
General Chemistry - Westborough Lab Associated sample(s): 06-07 QC Batch ID: WG1030455-3 QC Sample: L1726666-06 Client ID: FILTER B-1					
Chlorine, Total Residual	0.56	0.58	mg/l	4	20
General Chemistry - Westborough Lab Associated sample(s): 06-07 QC Batch ID: WG1030456-3 QC Sample: L1726666-07 Client ID: FILTER D-1					
Chlorine, Residual Free	ND	ND	mg/l	NC	

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1726666
Report Date: 08/23/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 06-07 QC Batch ID: WG1030501-2 QC Sample: L1727578-01 Client ID: DUP Sample					
pH	7.4	7.4	SU	0	5

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1726666
Report Date: 08/23/17

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(*)
L1726666-01A	Vial HCl preserved	A	NA		4.7	Y	Absent		524.2(14)
L1726666-01B	Vial HCl preserved	A	NA		4.7	Y	Absent		524.2(14)
L1726666-01C	Vial H2SO4 preserved	A	NA		4.7	Y	Absent		TOC-5310(28)
L1726666-01D	Vial H2SO4 preserved	A	NA		4.7	Y	Absent		TOC-5310(28)
L1726666-01E	Bacteria Cup Na2S2O3 preserved	A	NA		4.7	Y	Absent		T-COLI-C(1.25)
L1726666-01F	Bacteria Cup Na2S2O3 preserved	A	NA		4.7	Y	Absent		T-COLI-C(1.25)
L1726666-01G	Plastic 250ml NaOH preserved	A	>12	>12	4.7	Y	Absent		TCN-4500(14)
L1726666-01H	Plastic 250ml unpreserved/No Headspace	A	NA		4.7	Y	Absent		ALK-T-2320(14),CO2(1)
L1726666-01J	Plastic 120ml HNO3 preserved	A	<2	<2	4.7	Y	Absent		CD-2008T(180),AG-UI(180),CA-UI(180),NI-2008T(180),ZN-UI(180),BE-2008T(180),K-UI(180),FE-UI(180),HARDU(180),MG-UI(180),AS-2008T(180),HG-U(28),SE-2008T(180),AL-UI(180),BA-2008T(180),MN-UI(180),NA-UI(180),CR-2008T(180),CU-UI(180),SB-2008T(180),TL-2008T(180)
L1726666-01K	Plastic 250ml unpreserved	A	7	7	4.7	Y	Absent		-
L1726666-01L	Plastic 120ml Other preserved (sub-lab)	A	7	7	4.7	Y	Absent		SUB-BROMATE(0)
L1726666-01M	Plastic 950ml unpreserved	A	7	7	4.7	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),TURB-180(2),MBAS-5540(2),NO3-353(2),PH-4500(.01),TDS-2540(7)
L1726666-01N	Amber 1000ml unpreserved	A	7	7	4.7	Y	Absent		COLOR-T-2120(2),COLOR-A-2120(2),ODOR-2150(1)
L1726666-01X	Plastic 250ml HNO3 preserved Filtrates	A	<2	<2	4.7	Y	Absent		FE-RI(180),MN-RI(180)
L1726666-02A	Bacteria Cup Na2S2O3 preserved	A	NA		4.7	Y	Absent		T-COLI-C(1.25)
L1726666-02B	Bacteria Cup Na2S2O3 preserved	A	NA		4.7	Y	Absent		T-COLI-C(1.25)
L1726666-02C	Plastic 120ml HNO3 preserved	A	<2	<2	4.7	Y	Absent		CA-UI(180),FE-UI(180),HARDU(180),AL-UI(180),MN-UI(180),CU-UI(180)
L1726666-02D	Plastic 250ml unpreserved/No Headspace	A	NA		4.7	Y	Absent		ALK-T-2320(14),CO2(1)

*Values in parentheses indicate holding time in days

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1726666-02E	Plastic 250ml unpreserved	A	7	7	4.7	Y	Absent		SO4-300(28),CL-300(28),TURB-180(2),NO3-353(2),PH-4500(.01)
L1726666-02F	Amber 500ml unpreserved	A	7	7	4.7	Y	Absent		COLOR-T-2120(2),COLOR-A-2120(2)
L1726666-03A	Bacteria Cup Na2S2O3 preserved	A	NA		4.7	Y	Absent		T-COLI-C(1.25)
L1726666-03B	Bacteria Cup Na2S2O3 preserved	A	NA		4.7	Y	Absent		T-COLI-C(1.25)
L1726666-03C	Plastic 120ml HNO3 preserved	A	<2	<2	4.7	Y	Absent		CA-UI(180),FE-UI(180),HARDU(180),AL-UI(180),MN-UI(180),CU-UI(180)
L1726666-03D	Plastic 250ml unpreserved/No Headspace	A	NA		4.7	Y	Absent		ALK-T-2320(14),CO2(1)
L1726666-03E	Plastic 250ml unpreserved	A	7	7	4.7	Y	Absent		SO4-300(28),CL-300(28),TURB-180(2),NO3-353(2),PH-4500(.01)
L1726666-03F	Amber 500ml unpreserved	A	7	7	4.7	Y	Absent		COLOR-T-2120(2),COLOR-A-2120(2),DOC-5310(28)
L1726666-03G	Vial H2SO4 preserved	A	NA		4.7	Y	Absent		TOC-5310(28)
L1726666-03H	Vial H2SO4 preserved	A	NA		4.7	Y	Absent		TOC-5310(28)
L1726666-03J	Vial H2SO4 preserved	A	N/A	N/A	4.7	Y	Absent		HOLD-WETCHEM(0)
L1726666-03K	Vial H2SO4 preserved	A	N/A	N/A	4.7	Y	Absent		HOLD-WETCHEM(0)
L1726666-03L	Plastic 120ml Other preserved (sub-lab)	A	7	7	4.7	Y	Absent		SUB-BROMATE(0)
L1726666-03X	Vial H2SO4 preserved split	A	NA		4.7	Y	Absent		DOC-5310(28)
L1726666-03X1	Vial H2SO4 preserved split	A	NA		4.7	Y	Absent		DOC-5310(28)
L1726666-04A	Bacteria Cup Na2S2O3 preserved	A	NA		4.7	Y	Absent		T-COLI-C(1.25)
L1726666-04B	Bacteria Cup Na2S2O3 preserved	A	NA		4.7	Y	Absent		T-COLI-C(1.25)
L1726666-04C	Plastic 120ml HNO3 preserved	A	<2	<2	4.7	Y	Absent		CA-UI(180),FE-UI(180),HARDU(180),AL-UI(180),MN-UI(180),CU-UI(180)
L1726666-04D	Plastic 250ml unpreserved/No Headspace	A	NA		4.7	Y	Absent		ALK-T-2320(14),CO2(1)
L1726666-04E	Plastic 250ml unpreserved	A	7	7	4.7	Y	Absent		SO4-300(28),CL-300(28),TURB-180(2),NO3-353(2),PH-4500(.01)
L1726666-04F	Amber 500ml unpreserved	A	7	7	4.7	Y	Absent		COLOR-T-2120(2),COLOR-A-2120(2)
L1726666-05A	Bacteria Cup Na2S2O3 preserved	A	NA		4.7	Y	Absent		T-COLI-C(1.25)
L1726666-05B	Bacteria Cup Na2S2O3 preserved	A	NA		4.7	Y	Absent		T-COLI-C(1.25)
L1726666-05C	Plastic 120ml HNO3 preserved	A	<2	<2	4.7	Y	Absent		CA-UI(180),FE-UI(180),HARDU(180),AL-UI(180),MN-UI(180),CU-UI(180)
L1726666-05D	Plastic 250ml unpreserved/No Headspace	A	NA		4.7	Y	Absent		ALK-T-2320(14),CO2(1)
L1726666-05E	Plastic 250ml unpreserved	A	7	7	4.7	Y	Absent		SO4-300(28),CL-300(28),TURB-180(2),NO3-353(2),PH-4500(.01)

*Values in parentheses indicate holding time in days

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1726666
Report Date: 08/23/17

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1726666-05F	Amber 500ml unpreserved	A	7	7	4.7	Y	Absent		COLOR-T-2120(2),COLOR-A-2120(2),DOC-5310(28)
L1726666-05G	Vial H2SO4 preserved	A	NA		4.7	Y	Absent		TOC-5310(28)
L1726666-05H	Vial H2SO4 preserved	A	NA		4.7	Y	Absent		TOC-5310(28)
L1726666-05J	Vial H2SO4 preserved	A	N/A	N/A	4.7	Y	Absent		HOLD-WETCHEM(0)
L1726666-05K	Vial H2SO4 preserved	A	N/A	N/A	4.7	Y	Absent		HOLD-WETCHEM(0)
L1726666-05L	Plastic 120ml Other preserved (sub-lab)	A	7	7	4.7	Y	Absent		SUB-BROMATE(0)
L1726666-05X	Vial H2SO4 preserved split	A	NA		4.7	Y	Absent		DOC-5310(28)
L1726666-05X1	Vial H2SO4 preserved split	A	NA		4.7	Y	Absent		DOC-5310(28)
L1726666-06A	Amber 1000ml unpreserved	A	7	7	4.7	Y	Absent		SDS(1)
L1726666-06B	Amber 1000ml unpreserved	A	7	7	4.7	Y	Absent		SDS(1)
L1726666-07A	Amber 1000ml unpreserved	A	7	7	4.7	Y	Absent		SDS(1)
L1726666-07B	Amber 1000ml unpreserved	A	7	7	4.7	Y	Absent		SDS(1)
L1726666-08X	Vial NH4Cl preserved split	A	N/A	N/A	4.7	Y	Absent		SUB-HAA(9)
L1726666-08X1	Vial NH4Cl preserved split	A	N/A	N/A	4.7	Y	Absent		SUB-HAA(9)
L1726666-08Y	Vial Ascorbic Acid/HCl preserved	A	NA		4.7	Y	Absent		524-THM(14)
L1726666-08Y1	Vial Ascorbic Acid/HCl preserved	A	NA		4.7	Y	Absent		524-THM(14)
L1726666-09X	Vial NH4Cl preserved split	A	N/A	N/A	4.7	Y	Absent		SUB-HAA(9)
L1726666-09X1	Vial NH4Cl preserved split	A	N/A	N/A	4.7	Y	Absent		SUB-HAA(9)
L1726666-09Y	Vial Ascorbic Acid/HCl preserved	A	NA		4.7	Y	Absent		524-THM(14)
L1726666-09Y1	Vial Ascorbic Acid/HCl preserved	A	NA		4.7	Y	Absent		524-THM(14)

*Values in parentheses indicate holding time in days

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1726666
Project Number:	20107	**Report Date:**	08/23/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1726666
Project Number:	20107	**Report Date:**	08/23/17

Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1726666
Project Number:	20107	**Report Date:**	08/23/17

REFERENCES

3	Methods for the Determination of Metals in Environmental Samples, Supplement I. EPA/600/R-94/111. May 1994.
8	Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. 19th Edition. 1995.
16	Methods for the Determination of Organic Compounds in Drinking Water - Supplement II. EPA/600/R-92/129, August 1992.
19	Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.
30	Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WPCF. 18th Edition. 1992.
44	Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.
121	Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

MANSFIELD CHAIN OF CUSTODY

PAGE 1 OF 2

ALPHA ANALYTICAL
WESTBORO, MA TEL: 508-898-9220 FAX: 508-898-9193
MANSFIELD, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab: 8/2/17

ALPHA Job #: L1726666

Client Information

Client: Bluelenf Inc
Address: 57 Dresser Hill Rd
Charlton, MA 01507
Phone: (508) 248-7094
Fax:
Email: egratton@bluelenfwater.com
☐ These samples have been previously analyzed by Alpha

Project Information

Project Name: Maher Well Pilot
Project Location: Barnstable, MA
Project #: 20107
Project Manager: Erik Gratton
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)
Date Due: Time:

Report Information - Data Deliverables

☐ FAX ☐ EMAIL
☒ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State /Fed Program	Criteria

Other Project Specific Requirements/Comments/Detection Limits:

PLEASE NOTE
MS/MSD (at unit cost) will be omitted unless you check here: ☐

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	ANALYSIS: pH, TDS, Sol. Turb, Cl, F, Co2, NO3, Temp, Conductivity, Foam	Dissolved Fe, Mn	Fe, Mn, TOC, SEC, Hardness	TCN	Alkalinity	Total Coliform	TOC	MTBE	Color (Std)	pH, Turb, Co2, NO3, Temp, Sol.	Fe, Mn, Ca, Na, Cl, Al, Cu, Hardness	Color	Sample Specific Comments	TOTAL # BOTTLES
26666-01	Raw-1	8/2/17	9:00	DW	ARD	1	1	1	1	1	2	2	2	1					13
02	Filter A-1									1	2				1	1	1		6
03	Filter B-1									1	2	2			1	1	1		13
04	Filter C-1									1	2				1	1	1		6
05	Filter D-1									1	2	2			1	1	1		13

SAMPLE HANDLING
Filtration
☐ Done
☐ Not needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

Container Type	P													
Preservative														

Relinquished By:	Date/Time	Received By:	Date/Time
	8/2/17 14:03	CMason	8/2/17 14:03

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

Serial_No:08231715:28

MANSFIELD CHAIN OF CUSTODY

PAGE 2 OF 2

Date Rec'd in Lab: 8/2/17

ALPHA Job #: L1726666

ALPHA ANALYTICAL

WESTBORO, MA TEL: 508-898-9220 FAX: 508-898-9193
MANSFIELD, MA TEL: 508-822-9300 FAX: 508-822-3288

Client Information

Client: Blueleaf Inc

Address: 57 Dresser Hill Rd, Charlton, MA 01507

Phone: (508) 248-7094

Fax:

Email: egrotton@blueleafwater.com

☐ These samples have been previously analyzed by Alpha

Project Information

Project Name: Maher Well Pilot

Project Location: Barnstable MA

Project #: 20107

Project Manager: Erik Grotton

ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)

Date Due: Time:

Report Information - Data Deliverables

☐ FAX ☐ EMAIL
☒ ADEx ☐ Add'l Deliverables

Regulatory Requirements/Report Limits

State /Fed Program | Criteria

Billing Information

☐ Same as Client info PO #:

Other Project Specific Requirements/Comments/Detection Limits:

PLEASE NOTE
MS/MSD (at unit cost) will be omitted unless you check here: ☐

ANALYSIS: DOC; SDS (TTHM, HAAS) / Bromate; G. See Ethan Leigh for SDS Parameters

SAMPLE HANDLING
Filtration
☐ Done
☐ Not needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	DOC	SDS (TTHM, HAAS)	Bromate	Sample Specific Comments	TOTAL # BOTTLES
	Raw-1	8/2/17	9:00	DW	ARD			1		13
	Filter A-1	↓	↓	↓	↓					6
26666-06	Filter B-1	↓	↓	↓	↓	2	2	1		13 5
	Filter C-1	↓	↓	↓	↓					6
07	Filter D-1	↓	↓	↓	↓	2	2	1		13 5

Container Type
Preservative

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	8/2/17 14:03	[signature]	8/2/17 14:03

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 101-09 (rev. 27-SEP-10)

SUB UPS: **Eurofins, Indiana** RS

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193

Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #:L1726666

Project Information

Project Name:

Project Location: MA

Project #:

Project Manager: Karyn Raymond

ALPHA Quote #:

Report Information Data Deliverables

☐ FAX ☐ EMAIL

☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Client Information

Client: Alpha Analytical Lab

Address: 8 Walkup Drive

Westborough, Ma 01581

Phone: 508-898-9220

Fax:

Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

Regulatory Requirements/Report Limits

State/Fed Program *Criteria*

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☒ No Are MCP Analytical Methods Required?

☐ Yes ☒ No Are CT RCP (Reasonable Confidence Protocols) Required?

Other Project Specific Requirements/Comments/Detection Limits:

Please reference Alpha Job # **L1726666** on this report.

ANALYSIS

SAMPLE HANDLING

Filtration

☐ Done

☐ Not Needed

☐ Lab to do

Preservation

☐ Lab to do

(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	BROMATE	Sample Specific Comments	TOTAL # BOTTLES
	RAW-1	08/02/17	09:00	DW		X		1
	FILTER B-1	08/02/17	09:00	DW		X		1
	FILTER D-1	08/02/17	09:00	DW		X		1

Container Type	P		-	-	-	-	-	-	-	-	-	-	
Preservative	EDA		-	-	-	-	-	-	-	-	-	-	

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

FORM NO: 01-01(I) (rev. 30-JUL-07)

SUB COURIER: Granite State, NH

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193
Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Client Information

Client: Alpha Analytical Lab
Address: 8 Walkup Drive
Westborough, Ma 01581
Phone: 508-898-9220
Fax:
Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Project Information

Project Name:
Project Location: MA
Project #:
Project Manager: Ethan Leighton
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

Other Project Specific Requirements/Comments/Detection Limits:
Please reference Alpha Job #L1726666 on this report.

Date Rec'd in Lab:

ALPHA Job #: L1726666

Report Information Data Deliverables

☐ FAX ☐ EMAIL
☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program | Criteria

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☐ No Are MCP Analytical Methods Required?
☐ Yes ☐ No Are CT RCP (Reasonable Confidence Protocols) Required?

ANALYSIS

SAMPLE HANDLING
Filtration
☐ Done
☐ Not Needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	HAA	Sample Specific Comments	TOTAL # BOTTLES
	FILTER B-1 (DAY 7)	8/2/17	09:00	DW		X		2
	FILTER D-1 (DAY 7)	8/2/17	09:00	DW		X		2

PLEASE ANSWER QUESTIONS ABOVE!

Container Type	V	-	-	-	-	-	-	-	-	-	-	-	
Preservative	J	-	-	-	-	-	-	-	-	-	-	-	

IS YOUR PROJECT MA MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

FORM NO: 01-01(I) (rev. 30-JUL-07)

SUB COURIER: Granite State, NH

CHAIN OF CUSTODY

ALPHA ANALYTICAL
Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193
Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab | ALPHA Job #: L1726666

Project Information

Project Name:

Project Location: MA

Project #:

Project Manager: Ethan Leighton

ALPHA Quote #:

Report Information — ☐ FAX ☐ EMAIL ☐ ADEx ☐ Add'l Deliverables

Data Deliverables

Billing Information — ☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program | Criteria

Client Information

Client: Alpha Analytical Lab
Address: 8 Walkup Drive
Westborough, Ma 01581
Phone: 508-898-9220
Fax:
Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☐ No Are MCP Analytical Methods Required?

☐ Yes ☐ No Are CT RCP (Reasonable Confidence Protocols) Required?

Other Project Specific Requirements/Comments/Detection Limits:

Please reference Alpha Job #L1726666 on this report.

ANALYSIS

SAMPLE HANDLING
Filtration
☐ Done
☐ Not Needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	HAA	Sample Specific Comments	TOTAL # BOTTLES
	FILTER B-1 (DAY 7)	8/2/17	09:00	DW		x		2
	FILTER D-1 (DAY 7)	8/2/17	09:00	DW		x		2

Container Type	V	-	-	-	-	-	-	-	-	-	-	-	
Preservative	J	-	-	-	-	-	-	-	-	-	-	-	

PLEASE ANSWER QUESTIONS ABOVE!

S YOUR PROJECT
MA MCP or CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time
	8/10/17		8/10/17 805
	8/10/17 1105		8/10/17 14:25

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

4.4

FORM NO: 01-01(I)
Rev. 30-JUL-07)

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LABORATORY REPORT

If you have any questions concerning this report, please do not hesitate to call us at (800) 332-4345 or (574) 233-4777.

eurofins | Eaton Analytical

STATE CERTIFICATION LIST

State	Certification	State	Certification
Alabama	40700	Montana	CERT0026
Alaska	IN00035	Nebraska	NE-OS-05-04
Arizona	AZ0432	Nevada	IN00035
Arkansas	IN00035	New Hampshire*	2124
California	2920	New Jersey*	IN598
Colorado	IN035	New Mexico	IN00035
Colorado Radiochemistry	IN035	New York*	11398
Connecticut	PH-0132	North Carolina	18700
Delaware	IN035	North Dakota	R-035
Florida*	E87775	Ohio	87775
Georgia	929	Oklahoma	D9508
Hawaii	IN035	Oregon (Primary AB)*	4074-001
Idaho	IN00035	Pennsylvania*	68-00466
Illinois*	200001	Puerto Rico	IN00035
Illinois Microbiology	17767	Rhode Island	LAO00343
Indiana Chemistry	C-71-01	South Carolina	95005
Indiana Microbiology	M-76-07	South Dakota	IN00035
Iowa	098	Tennessee	TN02973
Kansas*	E-10233	Texas*	T104704187-15-8
Kentucky	90056	Texas/TCEQ	TX207
Louisiana*	LA170006	Utah*	IN00035
Maine	IN00035	Vermont	VT-8775
Maryland	209	Virginia*	460275
Massachusetts	M-IN035	Washington	C837
Michigan	9926	West Virginia	9927 C
Minnesota*	018-999-338	Wisconsin	999766900
Mississippi	IN035	Wyoming	IN035
Missouri	880		

*NELAP/TNI Recognized Accreditation Bodies

Revision date: 05/15/2017

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LABORATORY CASE NARRATIVE

Client: Alpha Analytical Report #: 394723CN

All method QC was within acceptance limits.

Note: This report was amended on 08/23/17 to report results on EEA generic report format, at the request of the client.

08/23/2017

Authorized Signature Title Date

eurofins | Eaton Analytical

110 South Hill Street
South Bend, IN 46617
Tel: (574) 233-4777
Fax: (574) 233-8207
1 800 332 4345

Laboratory Report

Client: Alpha Analytica

Attn: Karyn Raymond
Eight Walkup Drive
Westborough, MA 01581

Report: 394723
Priority: Standard Written
Status: Final
PWS ID: Not Supplied

Sample Information

EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3748604	L1726666-Raw-1	317.0	08/02/17 09:00	Client	08/04/17 09:45
3748605	L1726666-Filter B-1	317.0	08/02/17 09:00	Client	08/04/17 09:45
3748606	L1726666-Filter D-1	317.0	08/02/17 09:00	Client	08/04/17 09:45

Report Summary

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call James Van Fleit at (574) 233-4777.

Note: This report may not be reproduced, except in full, without written approval from EEA.

Jim Van Fleit ASM

08/23/2017

Authorized Signature | Title | Date

Client Name: Alpha Analytica
Report #: 394723

Client Name: Alpha Analytica

Report #: 394723

Sampling Point: L1726666-Raw-1

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	08/08/17 09:15	3748604

Sampling Point: L1726666-Filter B-1

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	08/08/17 10:05	3748605

Sampling Point: L1726666-Filter D-1

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	08/08/17 11:20	3748606

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!

Client Name: Alpha Analytica Report #: 394723

Lab Definitions

Continuing Calibration Check Standard (CCC) / Continuing Calibration Verification (CCV) / Initial Calibration Verification Standard (ICV) / Initial Performance Check (IPC) - is a standard containing one or more of the target analytes that is prepared from the same standards used to calibrate the instrument. This standard is used to verify the calibration curve at the beginning of each analytical sequence, and may also be analyzed throughout and at the end of the sequence. The concentration of continuing standards may be varied, when prescribed by the reference method, so that the range of the calibration curve is verified on a regular basis. CCL, CCM, and CCH are the CCC standards at low, mid, and high concentration levels, respectively.

Internal Standards (IS) - are pure compounds with properties similar to the analytes of interest, which are added to field samples or extracts, calibration standards, and quality control standards at a known concentration. They are used to measure the relative responses of the analytes of interest and surrogates in the sample, calibration standard or quality control standard.

Laboratory Duplicate (LD) - is a field sample aliquot taken from the same sample container in the laboratory and analyzed separately using identical procedures. Analysis of laboratory duplicates provides a measure of the precision of the laboratory procedures.

Laboratory Fortified Blank (LFB) / Laboratory Control Sample (LCS) - is an aliquot of reagent water to which known concentrations of the analytes of interest are added. The LFB is analyzed exactly the same as the field samples. LFBs are used to determine whether the method is in control. FBL, FBM, and FBH are the LFB samples at low, mid, and high concentration levels, respectively.

Laboratory Method Blank (LMB) / Laboratory Reagent Blank (LRB) - is a sample of reagent water included in the sample batch analyzed in the same way as the associated field samples. The LMB is used to determine if method analytes or other background contamination have been introduced during the preparation or analytical procedure. The LMB is analyzed exactly the same as the field samples.

Laboratory Trip Blank (LTB) / Field Reagent Blank (FRB) - is a sample of laboratory reagent water placed in a sample container in the laboratory and treated as a field sample, including storage, preservation, and all analytical procedures. The FRB/LTB container follows the collection bottles to and from the collection site, but the FRB/LTB is not opened at any time during the trip. The FRB/LTB is primarily a travel blank used to verify that the samples were not contaminated during shipment.

Matrix Spike Duplicate Sample (MSD) / Laboratory Fortified Sample Matrix Duplicate (LFSMD) - is a sample aliquot taken from the same field sample source as the Matrix Spike Sample to which known quantities of the analytes of interest are added in the laboratory. The MSD is analyzed exactly the same as the field samples. Analysis of the MSD provides a measure of the precision of the laboratory procedures in a specific matrix. SDL, SDM, and SDH / LFSMDL, LFSMDM, and LFSMDH are the MSD or LFSMD at low, mid, and high concentration levels, respectively.

Matrix Spike Sample (MS) / Laboratory Fortified Sample Matrix (LFSM) - is a sample aliquot taken from field sample source to which known quantities of the analytes of interest are added in the laboratory. The MS is analyzed exactly the same as the field samples. The purpose is to demonstrate recovery of the analytes from a sample matrix to determine if the specific matrix contributes bias to the analytical results. MSL, MSM, and MSH / LFSML, LFSMM, and LFSMH are the MS or LFSM at low, mid, and high concentration levels, respectively.

Quality Control Standard (QCS) / Second Source Calibration Verification (SSCV) - is a solution containing known concentrations of the analytes of interest prepared from a source different from the source of the calibration standards. The solution is obtained from a second manufacturer or lot if the lot can be demonstrated by the manufacturer as prepared independently from other lots. The QCS sample is analyzed using the same procedures as field samples. The QCS is used as a check on the calibration standards used in the method on a routine basis.

Reporting Limit Check (RLC) / Initial Calibration Check Standard (ICCS) - is a procedural standard that is analyzed each day to evaluate instrument performance at or below the minimum reporting limit (MRL).

Surrogate Standard (SS) / Surrogate Analyte (SUR) - is a pure compound with properties similar to the analytes of interest, which is highly unlikely to be found in any field sample, that is added to the field samples, calibration standards, blanks and quality control standards before sample preparation. The SS is used to evaluate the efficiency of the sample preparation process.

SDB UPS: Eurofins, Indiana (KY)

324343

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CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA
TEL: 508-898-9220
FAX: 508-898-9193

Mansfield, MA
TEL: 508-822-9300
FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #:L1726666

Project Information

Project Name:

Project Location: MA

Project #:

Project Manager: Karyn Raymond

ALPHA Quote #:

Report Information Data Deliverables

☐ FAX ☐ EMAIL

☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #: 394723

Regulatory Requirements/Report Limits

State/Fed Program | Criteria

Client Information

Client: Alpha Analytical Lab

Address: 8 Walkup Drive

Westborough, Ma 01581

Phone: 508-898-9220

Fax:

Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☒ No Are MCP Analytical Methods Required?

☐ Yes ☒ No Are CT RCP (Reasonable Confidence Protocols) Required?

Other Project Specific Requirements/Comments/Detection Limits:

Please reference Alpha Job # **L1726666** on this report.

Wet

ANALYSIS

SAMPLE HANDLING
Filtration
☐ Done
☐ Not Needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

Sample Specific Comments

TOTAL # BOTTLES

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	BROMATE												TOTAL # BOTTLES
	RAW-1 3748604	08/02/17	09:00	DW		X												1
	FILTER B-1 605	08/02/17	09:00	DW		X												1
	FILTER D-1 606	08/02/17	09:00	DW		X												1

Container Type: P - - - - - - - - - - -

Preservative: EDA - - - - - - - - - - -

Serial_No:08231715:28

LEASE ANSWER QUESTIONS ABOVE!

S YOUR PROJECT
IA MCP or CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time
	8/3/17	KDW	8-4-17 09:15

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

(M NO: 01-01)
30-JUL-07

Page 7 of 7

GRANITE STATE ANALYTICAL SERVICES, LLC
22 Manchester Road, Unit 2, Derry, NH 03038
Phone (800) 699-9920 (603) 432-3044 Fax (603) 434-4837
http://www.granitestateanalytical.com/

CERTIFICATE OF ANALYSIS FOR DRINKING WATER

DATE PRINTED: 08/21/2017
CLIENT NAME: Alpha Analytical
CLIENT ADDRESS: 8 Walkup Dr.
Westborough, MA 01581

SAMPLE ID#: 1708-01534-001
SAMPLED BY: Client-Customer
SAMPLE ADDRESS: L1726666
Filter B-1 (Day 7)
MA
LOCATION:

Legend
Passes ✓
Fails EPA Primary ⊗
Fails EPA Secondary ▼
Fails State Guideline ✕
Attention ⚠

DATE AND TIME COLLECTED: 08/02/2017 9:00AM
DATE AND TIME RECEIVED: 08/10/2017 2:05PM
ANALYSIS PACKAGE: HAA GSA
RECEIPT TEMPERATURE: ON ICE 4.4° CELSIUS
CLIENT JOB #

Test Description	Results	Test Units	Pass /Fail	DQ Flag	RL	Limit	Method	Analyst	Date-Time Analyzed
Date Extracted	-					No Limit	EPA 552.2	ND-NH	08/15/17 9:30AM
Dibromoacetic Acid*	1.3	ug/L			1	No Limit	EPA 552.2	BM-NH	08/17/17 1:58AM
Dichloroacetic Acid*	<1	ug/L			1	No Limit	EPA 552.2	BM-NH	08/17/17 1:58AM
Monobromoacetic Acid*	<1	ug/L			1	No Limit	EPA 552.2	BM-NH	08/17/17 1:58AM
Monochloroacetic Acid*	<2	ug/L			2	No Limit	EPA 552.2	BM-NH	08/17/17 1:58AM
Total Haloacetic Acids*	1.3	ug/L	✓		1	60 ug/L	EPA 552.2	BM-NH	08/17/17 1:58AM
Trichloroacetic Acid*	<1	ug/L			1	No Limit	EPA 552.2	BM-NH	08/17/17 1:58AM
2,3-Dibromopropionic Acid	100	%				No Limit	EPA 552.2 - SS	BM-NH	08/17/17 1:58AM

The results presented in this report relate to the samples listed above in the condition in which they were received.
RL: "Reporting limit" means the lowest level of an analyte that can be accurately recovered from the matrix of interest.

Data Qualifier (DQ) Flags: None

*** MA Certified Analysis**

Donald A. D'Anjou, Ph. D.
Laboratory Director

This analysis meets Commonwealth of Massachusetts requirements except as noted.
State Certifications: | NH 1015 | MA M-NH003 | ME NH00003 | RI 101513 | VT VT-101507 |

GRANITE STATE ANALYTICAL SERVICES, LLC
22 Manchester Road, Unit 2, Derry, NH 03038
Phone (800) 699-9920 (603) 432-3044 Fax (603) 434-4837
http://www.granitestateanalytical.com/

CERTIFICATE OF ANALYSIS FOR DRINKING WATER

DATE PRINTED: 08/21/2017
CLIENT NAME: Alpha Analytical
CLIENT ADDRESS: 8 Walkup Dr.
Westborough, MA 01581

SAMPLE ID#: 1708-01534-002
SAMPLED BY: Client-Customer
SAMPLE ADDRESS: L1726666
Filter D-1 (Day 7)
MA
LOCATION:

DATE AND TIME COLLECTED: 08/02/2017 9:00AM
DATE AND TIME RECEIVED: 08/10/2017 2:05PM
ANALYSIS PACKAGE: HAA GSA
RECEIPT TEMPERATURE: ON ICE 4.4° CELSIUS
CLIENT JOB #

Legend
Passes ✓
Fails EPA Primary ⊗
Fails EPA Secondary ▽
Fails State Guideline ✕
Attention ⚠

Test Description	Results	Test Units	Pass /Fail	DQ Flag	RL	Limit	Method	Analyst	Date-Time Analyzed
Date Extracted	-					No Limit	EPA 552.2	ND-NH	08/15/17 9:30AM
Dibromoacetic Acid*	1.3	ug/L			1	No Limit	EPA 552.2	BM-NH	08/17/17 2:38AM
Dichloroacetic Acid*	<1	ug/L			1	No Limit	EPA 552.2	BM-NH	08/17/17 2:38AM
Monobromoacetic Acid*	<1	ug/L			1	No Limit	EPA 552.2	BM-NH	08/17/17 2:38AM
Monochloroacetic Acid*	<2	ug/L			2	No Limit	EPA 552.2	BM-NH	08/17/17 2:38AM
Total Haloacetic Acids*	1.3	ug/L	✓		1	60 ug/L	EPA 552.2	BM-NH	08/17/17 2:38AM
Trichloroacetic Acid*	<1	ug/L			1	No Limit	EPA 552.2	BM-NH	08/17/17 2:38AM
2,3-Dibromopropionic Acid	103	%				No Limit	EPA 552.2 - SS	BM-NH	08/17/17 2:38AM

The results presented in this report relate to the samples listed above in the condition in which they were received.
RL: "Reporting limit" means the lowest level of an analyte that can be accurately recovered from the matrix of interest.

Data Qualifier (DQ) Flags: None

*** MA Certified Analysis**

Donald A. D'Anjou, Ph. D.
Laboratory Director

This analysis meets Commonwealth of Massachusetts requirements except as noted.
State Certifications: | NH 1015 | MA M-NH003 | ME NH00003 | RI 101513 | VT VT-101507 |

ANALYTICAL REPORT

Lab Number:	L1726977
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Erik Grotton
Phone:	(508) 248-7094
Project Name:	BARNSTABLE, MA
Project Number:	Not Specified
Report Date:	08/21/17

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1726977-01	RAW 3	DW	BARNSTABLE, MA	08/03/17 10:00	08/03/17
L1726977-02	FILTER A3	DW	BARNSTABLE, MA	08/03/17 10:00	08/03/17
L1726977-03	FILTER C3	DW	BARNSTABLE, MA	08/03/17 10:00	08/03/17
L1726977-04	FILTER E3	DW	BARNSTABLE, MA	08/03/17 10:00	08/03/17
L1726977-05	FILTER F3	DW	BARNSTABLE, MA	08/03/17 10:00	08/03/17
L1726977-06	UV 3	DW	BARNSTABLE, MA	08/03/17 10:00	08/03/17
L1726977-07	FIELD BLANK	WATER	BARNSTABLE, MA	08/03/17 10:00	08/03/17

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

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. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated 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.

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 table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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 Client Service Representative 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 Client Services at 800-624-9220 with any questions.

Project Name:	BARNSTABLE, MA	**Lab Number:**	L1726977
Project Number:	Not Specified	**Report Date:**	08/21/17

Case Narrative (continued)

Sample Receipt

The samples were received at the laboratory above the required temperature range. The samples were transported to the laboratory in a cooler with [ice] and delivered directly from the sampling site.

Perfluorinated Alkyl Acids

L1726977-05, -06, and -07: The surrogate recovery was outside the individual acceptance criteria for perfluoro-n-[1,2-13c2]decanoic acid (13c-pfda); however, re-analysis achieved similar results: 133%, 153%, and 142%, respectively. The results of the re-analysis are reported; however, all associated compounds are considered to have a potential bias.

The WG1031619-3 LCSD recovery, associated with L1726977-01, -04, -05, and -06, was outside the individual acceptance criteria for perfluorooctanoic acid (pfoa); however, re-analysis achieved a similar result: 133%. The results of the re-analysis are reported; however, all associated compounds are considered to have a potential bias.

The WG1031620-3 LCSD recovery, associated with L1726977-07, was outside the individual acceptance criteria for perfluorooctanoic acid (pfoa); however, re-analysis achieved a similar result: 133%. The results of the re-analysis are reported; however, all associated compounds are considered to have a potential bias.

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: Kelly Stenstrom

Title: Technical Director/Representative Date: 08/21/17

ORGANICS

SEMIVOLATILES

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1726977-01
Client ID: RAW 3
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/10/17 20:44
Analyst: TJ

Date Collected: 08/03/17 10:00
Date Received: 08/03/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/10/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.628		ug/l	0.160	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	85		70-130

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1726977-01
Client ID: RAW 3
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/18/17 23:33
Analyst: AR

Date Collected: 08/03/17 10:00
Date Received: 08/03/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	16.9		ng/l	1.78	--	1
Perfluorooctanesulfonic Acid (PFOS)	80.2		ng/l	1.78	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	117		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	115		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	85		70-130

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1726977-04
Client ID: FILTER E3
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/10/17 21:27
Analyst: TJ

Date Collected: 08/03/17 10:00
Date Received: 08/03/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/10/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.299		ug/l	0.160	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	97		70-130

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1726977-04
Client ID: FILTER E3
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/18/17 23:42
Analyst: AR

Date Collected: 08/03/17 10:00
Date Received: 08/03/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.78	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.78	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	121		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	125		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	97		70-130

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1726977-05
Client ID: FILTER F3
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/10/17 22:10
Analyst: TJ

Date Collected: 08/03/17 10:00
Date Received: 08/03/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/10/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.279		ug/l	0.163	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	94		70-130

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1726977-05 R
Client ID: FILTER F3
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/18/17 23:51
Analyst: AR

Date Collected: 08/03/17 10:00
Date Received: 08/03/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.78	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.78	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	123		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**133**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	102		70-130

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1726977-06
Client ID: UV 3
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/10/17 22:32
Analyst: TJ

Date Collected: 08/03/17 10:00
Date Received: 08/03/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/10/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.691		ug/l	0.163	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	103		70-130

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1726977-06 R
Client ID: UV 3
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/19/17 00:00
Analyst: AR

Date Collected: 08/03/17 10:00
Date Received: 08/03/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	17.5		ng/l	1.78	--	1
Perfluorooctanesulfonic Acid (PFOS)	91.0		ng/l	1.78	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	125		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**153**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	119		70-130

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1726977-07 R
Client ID: FIELD BLANK
Sample Location: BARNSTABLE, MA

Matrix: Water
Analytical Method: 122,537
Analytical Date: 08/19/17 00:10
Analyst: AR

Date Collected: 08/03/17 10:00
Date Received: 08/03/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.78	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.78	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	117		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**142**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	106		70-130

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 120,522
Analytical Date: 08/10/17 12:20
Analyst: TJ

Extraction Method: EPA 522
Extraction Date: 08/10/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL
1,4 Dioxane by EPA 522 - Mansfield Lab for sample(s): 01,04-06 Batch: WG1030897-1					
1,4-Dioxane	ND		ug/l	0.150	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	112		70-130

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 122,537
Analytical Date: 08/18/17 22:19
Analyst: AR

Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab for sample(s): 01,04-06 Batch: WG1031619-1					
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	116		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	123		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	106		70-130

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 122,537
Analytical Date: 08/18/17 22:19
Analyst: AR

Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab for sample(s): 07 Batch: WG1031620-1					
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	116		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	123		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	106		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: BARNSTABLE, MA

Project Number: Not Specified

Lab Number: L1726977

Report Date: 08/21/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01,04-06 Batch: WG1030897-2 WG1030897-3								
1,4-Dioxane	94		98		70-130	4		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,4-Dioxane-d8	110		111		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: BARNSTABLE, MA

Project Number: Not Specified

Lab Number: L1726977

Report Date: 08/21/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01,04-06 Batch: WG1031619-2 WG1031619-3								
Perfluorooctanoic Acid (PFOA)	128		**133**	Q	70-130	4		30
Perfluorooctanesulfonic Acid (PFOS)	121		123		70-130	2		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	124		**132**	Q	70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**135**	Q	**142**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	122		128		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: BARNSTABLE, MA

Project Number: Not Specified

Lab Number: L1726977

Report Date: 08/21/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 07 Batch: WG1031620-2 WG1031620-3								
Perfluorooctanoic Acid (PFOA)	128		**133**	Q	70-130	4		30
Perfluorooctanesulfonic Acid (PFOS)	121		123		70-130	2		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	124		**132**	Q	70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**135**	Q	**142**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	122		128		70-130

Matrix Spike Analysis

Batch Quality Control

Project Name: BARNSTABLE, MA

Project Number: Not Specified

Lab Number: L1726977

Report Date: 08/21/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab	Associated sample(s): 01,04-06	QC Batch ID: WG1030897-5	QC Sample: L1726977-04	Client ID: FILTER E3								
1,4-Dioxane	0.299	10.9	9.91	88		-	-		70-130	-		30

Surrogate	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
1,4-Dioxane-d8	98				70-130

Lab Duplicate Analysis
Batch Quality Control

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01,04-06 QC Batch ID: WG1030897-4 QC Sample: L1726977-01 Client ID: RAW 3						
1,4-Dioxane	0.628	0.721	ug/l	14		30

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	85		101		70-130

METALS

Project Name: BARNSTABLE, MA
Project Number: Not Specified
Lab Number: L1726977
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1726977-01
Client ID: RAW 3
Sample Location: BARNSTABLE, MA
Matrix: Dw
Date Collected: 08/03/17 10:00
Date Received: 08/03/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.058		mg/l	0.050	--	1	08/09/17 12:10	08/09/17 20:22	EPA 3005A	19,200.7	PS
Manganese, Total	0.040		mg/l	0.0010	--	1	08/09/17 12:10	08/10/17 09:50	EPA 3005A	3,200.8	AM

Project Name: BARNSTABLE, MA
Project Number: Not Specified
Lab Number: L1726977
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1726977-02
Client ID: FILTER A3
Sample Location: BARNSTABLE, MA
Matrix: Dw
Date Collected: 08/03/17 10:00
Date Received: 08/03/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	08/09/17 12:10	08/09/17 20:26	EPA 3005A	19,200.7	PS
Manganese, Total	0.0026		mg/l	0.0010	--	1	08/09/17 12:10	08/10/17 09:54	EPA 3005A	3,200.8	AM

Project Name: BARNSTABLE, MA
Project Number: Not Specified
Lab Number: L1726977
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1726977-03
Client ID: FILTER C3
Sample Location: BARNSTABLE, MA
Matrix: Dw
Date Collected: 08/03/17 10:00
Date Received: 08/03/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	08/09/17 12:10	08/09/17 20:30	EPA 3005A	19,200.7	PS
Manganese, Total	0.0030		mg/l	0.0010	--	1	08/09/17 12:10	08/10/17 09:58	EPA 3005A	3,200.8	AM

Project Name: BARNSTABLE, MA
Project Number: Not Specified
Lab Number: L1726977
Report Date: 08/21/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-03 Batch: WG1030329-1										
Manganese, Total	ND		mg/l	0.0010	--	1	08/09/17 12:10	08/10/17 09:26	3,200.8	AM

Prep Information

Digestion Method: EPA 3005A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-03 Batch: WG1030338-1										
Iron, Total	ND		mg/l	0.050	--	1	08/09/17 12:10	08/09/17 19:24	19,200.7	PS

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis

Batch Quality Control

Project Name: BARNSTABLE, MA

Project Number: Not Specified

Lab Number: L1726977

Report Date: 08/21/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-03 Batch: WG1030329-2								
Manganese, Total	114		-		85-115	-		
Total Metals - Mansfield Lab Associated sample(s): 01-03 Batch: WG1030338-2								
Iron, Total	112		-		85-115	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-03 QC Batch ID: WG1030329-3 QC Sample: L1726830-02 Client ID: MS Sample												
Manganese, Total	0.0913	0.5	0.6372	109		-	-		70-130	-		20
Total Metals - Mansfield Lab Associated sample(s): 01-03 QC Batch ID: WG1030338-3 QC Sample: L1726830-02 Client ID: MS Sample												
Iron, Total	ND	1	1.14	114		-	-		75-125	-		20

Lab Duplicate Analysis
Batch Quality Control

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-03 QC Batch ID: WG1030338-4 QC Sample: L1726830-02 Client ID: DUP Sample						
Iron, Total	ND	ND	mg/l	NC		20

INORGANICS
&
MISCELLANEOUS

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1726977-01
Client ID: RAW 3
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/03/17 10:00
Date Received: 08/03/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	ND		NTU	0.20	--	1	-	08/04/17 05:30	44,180.1	VB
Alkalinity, Total	15.5		mg CaCO3/L	2.00	NA	1	-	08/04/17 04:57	121,2320B	KA
pH (H)	5.8		SU	-	NA	1	-	08/04/17 07:55	121,4500H+-B	VB

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1726977-02
Client ID: FILTER A3
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/03/17 10:00
Date Received: 08/03/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	ND		NTU	0.20	--	1	-	08/04/17 05:30	44,180.1	VB
Alkalinity, Total	43.5		mg CaCO3/L	2.00	NA	1	-	08/04/17 04:57	121,2320B	KA

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1726977-03
Client ID: FILTER C3
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/03/17 10:00
Date Received: 08/03/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	ND		NTU	0.20	--	1	-	08/04/17 05:30	44,180.1	VB
Alkalinity, Total	42.0		mg CaCO3/L	2.00	NA	1	-	08/04/17 04:57	121,2320B	KA

Project Name: BARNSTABLE, MA
Project Number: Not Specified
Lab Number: L1726977
Report Date: 08/21/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01-03 Batch: WG1028787-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	08/04/17 04:57	121,2320B	KA
General Chemistry - Westborough Lab for sample(s): 01-03 Batch: WG1028860-1										
Turbidity	ND		NTU	0.20	--	1	-	08/04/17 05:30	44,180.1	VB

Lab Control Sample Analysis

Batch Quality Control

Project Name: BARNSTABLE, MA

Project Number: Not Specified

Lab Number: L1726977

Report Date: 08/21/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-03 Batch: WG1028787-2								
Alkalinity, Total	105		-		90-110	-		10
General Chemistry - Westborough Lab Associated sample(s): 01-03 Batch: WG1028860-2								
Turbidity	99		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1028873-1								
pH	100		-		99-101	-		5

Matrix Spike Analysis
Batch Quality Control

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-03 QC Batch ID: WG1028787-4 QC Sample: L1726977-02 Client ID: FILTER A3												
Alkalinity, Total	43.5	100	140	96		-	-		86-116	-		10

Lab Duplicate Analysis
Batch Quality Control

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-03 QC Batch ID: WG1028787-3 QC Sample: L1726977-02 Client ID: FILTER A3						
Alkalinity, Total	43.5	42.6	mg CaCO3/L	2		10
General Chemistry - Westborough Lab Associated sample(s): 01-03 QC Batch ID: WG1028860-3 QC Sample: L1726977-01 Client ID: RAW 3						
Turbidity	ND	ND	NTU	NC		13
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1028873-2 QC Sample: L1726916-01 Client ID: DUP Sample						
pH	7.8	7.8	SU	0		5

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent
B	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1726977-01A	Plastic 120ml HNO3 preserved	A	<2	<2	7.4	Y	Absent		MN-2008T(180),FE-UI(180)
L1726977-01B	Plastic 250ml unpreserved/No Headspace	A	NA		7.4	Y	Absent		ALK-T-2320(14),TURB-180(2),PH-4500(.01)
L1726977-01C	Plastic 250ml Trizma preserved	A	NA		7.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1726977-01D	Plastic 250ml Trizma preserved	A	NA		7.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1726977-01E	Plastic 250ml Trizma preserved	A	NA		7.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1726977-01F	Amber 500ml NaSulfite/NaHSO4 preserved	A	6	6	7.4	Y	Absent		A2-14DIOXANE-522(28)
L1726977-01G	Amber 500ml NaSulfite/NaHSO4 preserved	A	6	6	7.4	Y	Absent		A2-14DIOXANE-522(28)
L1726977-02A	Plastic 120ml HNO3 preserved	A	<2	<2	7.4	Y	Absent		MN-2008T(180),FE-UI(180)
L1726977-02B	Plastic 120ml unpreserved	A	7	7	7.4	Y	Absent		TURB-180(2)
L1726977-02C	Plastic 250ml unpreserved/No Headspace	A	NA		7.4	Y	Absent		ALK-T-2320(14)
L1726977-03A	Plastic 120ml HNO3 preserved	A	<2	<2	7.4	Y	Absent		MN-2008T(180),FE-UI(180)
L1726977-03B	Plastic 120ml unpreserved	A	7	7	7.4	Y	Absent		TURB-180(2)
L1726977-03C	Plastic 250ml unpreserved/No Headspace	A	NA		7.4	Y	Absent		ALK-T-2320(14)
L1726977-04A	Plastic 250ml Trizma preserved	B	NA		8.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1726977-04B	Plastic 250ml Trizma preserved	B	NA		8.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1726977-04C	Plastic 250ml Trizma preserved	B	NA		8.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1726977-04D	Amber 500ml NaSulfite/NaHSO4 preserved	B	6	6	8.0	Y	Absent		A2-14DIOXANE-522(28)
L1726977-04E	Amber 500ml NaSulfite/NaHSO4 preserved	B	6	6	8.0	Y	Absent		A2-14DIOXANE-522(28)
L1726977-05A	Plastic 250ml Trizma preserved	B	NA		8.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1726977-05B	Plastic 250ml Trizma preserved	B	NA		8.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1726977-05C	Plastic 250ml Trizma preserved	B	NA		8.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1726977-05D	Amber 500ml NaSulfite/NaHSO4 preserved	B	6	6	8.0	Y	Absent		A2-14DIOXANE-522(28)

*Values in parentheses indicate holding time in days

Project Name: BARNSTABLE, MA
Project Number: Not Specified

Lab Number: L1726977
Report Date: 08/21/17

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1726977-05E	Amber 500ml NaSulfite/NaHSO4 preserved	B	6	6	8.0	Y	Absent		A2-14DIOXANE-522(28)
L1726977-06A	Plastic 250ml Trizma preserved	B	NA		8.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1726977-06B	Plastic 250ml Trizma preserved	B	NA		8.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1726977-06C	Plastic 250ml Trizma preserved	B	NA		8.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1726977-06D	Amber 500ml NaSulfite/NaHSO4 preserved	B	6	6	8.0	Y	Absent		A2-14DIOXANE-522(28)
L1726977-06E	Amber 500ml NaSulfite/NaHSO4 preserved	B	6	6	8.0	Y	Absent		A2-14DIOXANE-522(28)
L1726977-07A	Plastic 250ml Trizma preserved	B	NA		8.0	Y	Absent		A2-537-PFOA/PFOS(14)

*Values in parentheses indicate holding time in days

Project Name:	BARNSTABLE, MA	**Lab Number:**	L1726977
Project Number:	Not Specified	**Report Date:**	08/21/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	BARNSTABLE, MA	**Lab Number:**	L1726977
Project Number:	Not Specified	**Report Date:**	08/21/17

Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

REFERENCES

3 Methods for the Determination of Metals in Environmental Samples, Supplement I. EPA/600/R-94/111. May 1994.

19 Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

120 Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography/Mass Spectrometry (GC/MS) with Selected Ion Monitoring (SIM). EPA Method 522, EPA/600/R-08/101. Version 1.0, September 2008.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

122 Determination of Selected Perfluorintated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). EPA Method 537, EPA/600/R-08/092. Version 1.1, September 2009.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

ALPHA ANALYTICAL
World Class Chemistry

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Westboro, MA 01581
Tel: 508-898-9220

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

CHAIN OF CUSTODY

PAGE______ OF ______

Date Rec'd in Lab: 8-3-17

ALPHA Job #: L1726977

Client Information

Client: BLUELEAF INC.

Address: 57 PRESSER HILL RD
CHARLTON, MA 01507

Phone: (508) 294-3714

Email: egrotton@blueleafwater.com

Additional Project Information:

Project Information

Project Name: BARNSTABLE, MA

Project Location: BARNSTABLE, MA

Project #:

Project Manager: ERIK GROTTON

ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH *(only confirmed if pre-approved!)*

Date Due:

Report Information - Data Deliverables

☐ ADEx ☒ EMAIL

Billing Information

☒ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program ____________ Criteria ____________

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	VOC: ☐ 8260 ☐ 624 ☐ 524.2	SVOC: ☐ ABN ☐ PAH	METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15	METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13	EPH: ☐ Ranges & Targets ☐ Ranges Only	VPH: ☐ Ranges & Targets ☐ Ranges Only	☐ PCB ☐ PEST	TPH: ☐ Quant Only ☐ Fingerprint	Fe(total), Mn(total)	Alk, [illegible], turbidity	1,4-dioxane	PFOC/PFOA	pH		Sample Comments	TOTAL # BOTTLES
26977-01	RAW 3	8/3/17	10[00]	DW	CAW									X	X	X	X	X			7
-02	FILTER A 3	↓	↓	↓	↓									X	X						3
-03	FILTER C 3	↓	↓	↓	↓									X	X						3
-04	FILTER E 3	↓	↓	↓	↓											X	X				5
-05	FILTER F 3	↓	↓	↓	↓											X	X				5
-06	UV 3	↓	↓	↓	↓											X	X				5
-07	Field Blank	↓	↓	↓	↓												X				2

(30)

SAMPLE INFO
Filtration
☐ Field
☐ Lab to do
Preservation
☐ Lab to do

Container Type
Preservative

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	8/3/17 1549	[signature] AAL	8/3/17 1549

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

ANALYTICAL REPORT

Lab Number:	L1727204
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Erik Grotton
Phone:	(508) 248-7094
Project Name:	MAHER WELLS
Project Number:	20107
Report Date:	08/21/17

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1727204
Report Date: 08/21/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1727204-01	RAW 4	DW	BARNSTABLE, MA	08/04/17 10:00	08/04/17
L1727204-02	FILTER A4	DW	BARNSTABLE, MA	08/04/17 10:00	08/04/17
L1727204-03	FILTER C4	DW	BARNSTABLE, MA	08/04/17 10:00	08/04/17
L1727204-04	UV EFF4	DW	BARNSTABLE, MA	08/04/17 10:00	08/04/17
L1727204-05	FILTER E4	DW	BARNSTABLE, MA	08/04/17 10:00	08/04/17
L1727204-06	FILTER F4	DW	BARNSTABLE, MA	08/04/17 10:00	08/04/17

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1727204
Report Date: 08/21/17

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. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated 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.

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 table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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 Client Service Representative 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 Client Services at 800-624-9220 with any questions.

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1727204
Report Date: 08/21/17

Case Narrative (continued)

Perfluorinated Alkyl Acids

L1727204-04 and -06: The surrogate recovery was outside the individual acceptance criteria for perfluoro-n-[1,2-13c2]decanoic acid (13c-pfda); however, re-analysis achieved similar results: 137% and 136%, respectively. The results of the re-analysis are reported; however, all associated compounds are considered to have a potential bias.

The WG1031619-3 LCSD recovery, associated with L1727204-01, -04, -05, and -06, was outside the individual acceptance criteria for perfluorooctanoic acid (pfoa); however, re-analysis achieved a similar result: 133%. The results of the re-analysis are reported; however, all associated compounds are considered to have a potential bias.

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: Kelly Stenstrom

Title: Technical Director/Representative Date: 08/21/17

ORGANICS

SEMIVOLATILES

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1727204
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1727204-01
Client ID: RAW 4
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/11/17 00:22
Analyst: TJ

Date Collected: 08/04/17 10:00
Date Received: 08/04/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/10/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.590		ug/l	0.156	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	86		70-130

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1727204
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1727204-01
Client ID: RAW 4
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/18/17 22:28
Analyst: AR

Date Collected: 08/04/17 10:00
Date Received: 08/04/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	18.2		ng/l	1.85	--	1
Perfluorooctanesulfonic Acid (PFOS)	87.8		ng/l	1.85	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	109		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	117		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	93		70-130

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1727204
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1727204-04
Client ID: UV EFF4
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/11/17 00:44
Analyst: TJ

Date Collected: 08/04/17 10:00
Date Received: 08/04/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/10/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.633		ug/l	0.156	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	93		70-130

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1727204
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1727204-04
Client ID: UV EFF4
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/18/17 22:46
Analyst: AR

Date Collected: 08/04/17 10:00
Date Received: 08/04/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	16.7		ng/l	1.85	--	1
Perfluorooctanesulfonic Acid (PFOS)	68.9		ng/l	1.85	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	122		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**137**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	115		70-130

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1727204
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1727204-05
Client ID: FILTER E4
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/11/17 01:28
Analyst: TJ

Date Collected: 08/04/17 10:00
Date Received: 08/04/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/10/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.316		ug/l	0.156	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	91		70-130

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1727204
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1727204-05
Client ID: FILTER E4
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/18/17 23:05
Analyst: AR

Date Collected: 08/04/17 10:00
Date Received: 08/04/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.85	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.85	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	126		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	128		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	97		70-130

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1727204
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1727204-06
Client ID: FILTER F4
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/11/17 01:50
Analyst: TJ

Date Collected: 08/04/17 10:00
Date Received: 08/04/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/10/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.309		ug/l	0.153	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	95		70-130

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1727204
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1727204-06
Client ID: FILTER F4
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/18/17 23:14
Analyst: AR

Date Collected: 08/04/17 10:00
Date Received: 08/04/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.92	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.92	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	127		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**136**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	109		70-130

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1727204
Report Date: 08/21/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 120,522
Analytical Date: 08/10/17 12:20
Analyst: TJ

Extraction Method: EPA 522
Extraction Date: 08/10/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL
1,4 Dioxane by EPA 522 - Mansfield Lab for sample(s): 01,04-06 Batch: WG1030897-1					
1,4-Dioxane	ND		ug/l	0.150	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	112		70-130

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1727204
Report Date: 08/21/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 122,537
Analytical Date: 08/18/17 22:19
Analyst: AR

Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab for sample(s): 01,04-06 Batch: WG1031619-1					
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	116		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	123		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	106		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELLS

Project Number: 20107

Lab Number: L1727204

Report Date: 08/21/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01,04-06 Batch: WG1030897-2 WG1030897-3								
1,4-Dioxane	94		98		70-130	4		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,4-Dioxane-d8	110		111		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELLS

Project Number: 20107

Lab Number: L1727204

Report Date: 08/21/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01,04-06 Batch: WG1031619-2 WG1031619-3								
Perfluorooctanoic Acid (PFOA)	128		**133**	Q	70-130	4		30
Perfluorooctanesulfonic Acid (PFOS)	121		123		70-130	2		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	124		**132**	Q	70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**135**	Q	**142**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	122		128		70-130

Matrix Spike Analysis

Batch Quality Control

Project Name: MAHER WELLS

Project Number: 20107

Lab Number: L1727204

Report Date: 08/21/17

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 - Mansfield Lab EFF4	Associated sample(s): 01,04-06		QC Batch ID: WG1031619-5			QC Sample: L1727204-04			Client ID: UV			
Perfluorooctanoic Acid (PFOA)	16.7	37	67.9	**138**	Q	-	-		70-130	-		30
Perfluorooctanesulfonic Acid (PFOS)	68.9	34.3	117	**140**	Q	-	-		70-130	-		30

Surrogate	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	124				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**151**	Q			70-130
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	125				70-130

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1727204
Report Date: 08/21/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01,04-06 QC Batch ID: WG1031619-4 QC Sample: L1727204-01 Client ID: RAW 4						
Perfluorooctanoic Acid (PFOA)	18.2	18.9	ng/l	4		30
Perfluorooctanesulfonic Acid (PFOS)	87.8	84.8	ng/l	3		30

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	109		123		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	117		126		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	93		95		70-130

METALS

Project Name: MAHER WELLS
Lab Number: L1727204
Project Number: 20107
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1727204-01
Client ID: RAW 4
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/04/17 10:00
Date Received: 08/04/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.063		mg/l	0.050	--	1	08/08/17 10:15	08/10/17 13:57	EPA 3005A	19,200.7	PS
Manganese, Total	0.044		mg/l	0.010	--	1	08/08/17 10:15	08/10/17 13:57	EPA 3005A	19,200.7	PS

Project Name: MAHER WELLS
Lab Number: L1727204
Project Number: 20107
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1727204-02
Client ID: FILTER A4
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/04/17 10:00
Date Received: 08/04/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	08/08/17 10:15	08/10/17 14:02	EPA 3005A	19,200.7	PS
Manganese, Total	ND		mg/l	0.010	--	1	08/08/17 10:15	08/10/17 14:02	EPA 3005A	19,200.7	PS

Project Name: MAHER WELLS
Lab Number: L1727204
Project Number: 20107
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1727204-03
Client ID: FILTER C4
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/04/17 10:00
Date Received: 08/04/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	08/08/17 10:15	08/10/17 14:07	EPA 3005A	19,200.7	PS
Manganese, Total	ND		mg/l	0.010	--	1	08/08/17 10:15	08/10/17 14:07	EPA 3005A	19,200.7	PS

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1727204
Report Date: 08/21/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-03 Batch: WG1029844-1										
Iron, Total	ND		mg/l	0.050	--	1	08/08/17 10:15	08/10/17 12:37	19,200.7	PS
Manganese, Total	ND		mg/l	0.010	--	1	08/08/17 10:15	08/10/17 12:37	19,200.7	PS

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELLS

Project Number: 20107

Lab Number: L1727204

Report Date: 08/21/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-03 Batch: WG1029844-2								
Iron, Total	111		-		85-115	-		
Manganese, Total	107		-		85-115	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1727204
Report Date: 08/21/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-03 QC Batch ID: WG1029844-3 QC Sample: L1727176-02 Client ID: MS Sample												
Iron, Total	0.863	1	1.99	113		-	-		75-125	-		20
Manganese, Total	0.129	0.5	0.662	107		-	-		75-125	-		20
Total Metals - Mansfield Lab Associated sample(s): 01-03 QC Batch ID: WG1029844-7 QC Sample: L1727337-01 Client ID: MS Sample												
Iron, Total	ND	1	1.16	116		-	-		75-125	-		20
Manganese, Total	ND	0.5	0.555	111		-	-		75-125	-		20

INORGANICS
&
MISCELLANEOUS

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1727204
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1727204-01
Client ID: RAW 4
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/04/17 10:00
Date Received: 08/04/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	ND		NTU	0.20	--	1	-	08/05/17 05:26	44,180.1	KA
Alkalinity, Total	15.7		mg CaCO3/L	2.00	NA	1	-	08/05/17 03:50	121,2320B	KA
pH (H)	6.3		SU	-	NA	1	-	08/06/17 16:20	121,4500H+-B	JC

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1727204
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1727204-02
Client ID: FILTER A4
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/04/17 10:00
Date Received: 08/04/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	ND		NTU	0.20	--	1	-	08/05/17 05:26	44,180.1	KA
Alkalinity, Total	43.6		mg CaCO3/L	2.00	NA	1	-	08/05/17 03:50	121,2320B	KA
pH (H)	6.9		SU	-	NA	1	-	08/06/17 16:20	121,4500H+-B	JC

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1727204
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1727204-03
Client ID: FILTER C4
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/04/17 10:00
Date Received: 08/04/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.23		NTU	0.20	--	1	-	08/05/17 05:26	44,180.1	KA
Alkalinity, Total	43.6		mg CaCO3/L	2.00	NA	1	-	08/05/17 03:50	121,2320B	KA
pH (H)	6.9		SU	-	NA	1	-	08/06/17 16:20	121,4500H+-B	JC

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1727204
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1727204-05
Client ID: FILTER E4
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/04/17 10:00
Date Received: 08/04/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Total Organic Carbon	ND		mg/l	0.500	--	1	-	08/07/17 13:03	121,5310C	AG

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1727204
Report Date: 08/21/17

SAMPLE RESULTS

Lab ID: L1727204-06
Client ID: FILTER F4
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/04/17 10:00
Date Received: 08/04/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Total Organic Carbon	ND		mg/l	0.500	--	1	-	08/07/17 13:03	121,5310C	AG

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1727204
Report Date: 08/21/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01-03 Batch: WG1029164-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	08/05/17 03:50	121,2320B	KA
General Chemistry - Westborough Lab for sample(s): 01-03 Batch: WG1029169-1										
Turbidity	ND		NTU	0.20	--	1	-	08/05/17 05:26	44,180.1	KA
General Chemistry - Westborough Lab for sample(s): 05-06 Batch: WG1029445-1										
Total Organic Carbon	ND		mg/l	0.500	--	1	-	08/07/17 13:03	121,5310C	AG

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELLS

Project Number: 20107

Lab Number: L1727204

Report Date: 08/21/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-03 Batch: WG1029164-2								
Alkalinity, Total	107		-		90-110	-		10
General Chemistry - Westborough Lab Associated sample(s): 01-03 Batch: WG1029169-2								
Turbidity	100		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01-03 Batch: WG1029386-1								
pH	100		-		99-101	-		5
General Chemistry - Westborough Lab Associated sample(s): 05-06 Batch: WG1029445-2								
Total Organic Carbon	97		-		90-110	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1727204
Report Date: 08/21/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-03 QC Batch ID: WG1029164-4 QC Sample: L1727204-02 Client ID: FILTER A4												
Alkalinity, Total	43.6	100	143	99		-	-		86-116	-		10
General Chemistry - Westborough Lab Associated sample(s): 05-06 QC Batch ID: WG1029445-4 QC Sample: L1726601-01 Client ID: MS Sample												
Total Organic Carbon	7.31	8	14.9	95		-	-		80-120	-		20

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1727204
Report Date: 08/21/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-03 QC Batch ID: WG1029164-3 QC Sample: L1727204-02 Client ID: FILTER A4						
Alkalinity, Total	43.6	42.8	mg CaCO3/L	2		10
General Chemistry - Westborough Lab Associated sample(s): 01-03 QC Batch ID: WG1029169-3 QC Sample: L1727204-03 Client ID: FILTER C4						
Turbidity	0.23	0.23	NTU	0		13
General Chemistry - Westborough Lab Associated sample(s): 01-03 QC Batch ID: WG1029386-2 QC Sample: L1727204-01 Client ID: RAW 4						
pH (H)	6.3	6.3	SU	0		5
General Chemistry - Westborough Lab Associated sample(s): 05-06 QC Batch ID: WG1029445-3 QC Sample: L1726601-01 Client ID: DUP Sample						
Total Organic Carbon	7.31	7.17	mg/l	2		20

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1727204
Report Date: 08/21/17

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent
B	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1727204-01A	Plastic 120ml HNO3 preserved	A	<2	<2	5.1	Y	Absent		FE-UI(180),MN-UI(180)
L1727204-01B	Plastic 250ml unpreserved/No Headspace	A	NA		5.1	Y	Absent		ALK-T-2320(14),TURB-180(2),PH-4500(.01)
L1727204-01C	Plastic 250ml Trizma preserved	A	NA		5.1	Y	Absent		A2-537-PFOA/PFOS(14)
L1727204-01D	Plastic 250ml Trizma preserved	A	NA		5.1	Y	Absent		A2-537-PFOA/PFOS(14)
L1727204-01E	Plastic 250ml Trizma preserved	A	NA		5.1	Y	Absent		A2-537-PFOA/PFOS(14)
L1727204-01F	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.1	Y	Absent		A2-14DIOXANE-522(28)
L1727204-01G	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.1	Y	Absent		A2-14DIOXANE-522(28)
L1727204-02A	Plastic 120ml unpreserved	A	8	8	5.1	Y	Absent		TURB-180(2),PH-4500(.01)
L1727204-02B	Plastic 120ml HNO3 preserved	A	<2	<2	5.1	Y	Absent		FE-UI(180),MN-UI(180)
L1727204-02C	Plastic 250ml unpreserved/No Headspace	A	NA		5.1	Y	Absent		ALK-T-2320(14)
L1727204-03A	Plastic 120ml unpreserved	A	8	8	5.1	Y	Absent		TURB-180(2),PH-4500(.01)
L1727204-03B	Plastic 120ml HNO3 preserved	A	<2	<2	5.1	Y	Absent		FE-UI(180),MN-UI(180)
L1727204-03C	Plastic 250ml unpreserved/No Headspace	A	NA		5.1	Y	Absent		ALK-T-2320(14)
L1727204-04A	Plastic 250ml Trizma preserved	B	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1727204-04B	Plastic 250ml Trizma preserved	B	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1727204-04C	Plastic 250ml Trizma preserved	B	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1727204-04D	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.1	Y	Absent		A2-14DIOXANE-522(28)
L1727204-04E	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.1	Y	Absent		A2-14DIOXANE-522(28)
L1727204-05A	Vial H2SO4 preserved	A	NA		5.1	Y	Absent		TOC-5310(28)
L1727204-05B	Vial H2SO4 preserved	A	NA		5.1	Y	Absent		TOC-5310(28)
L1727204-05C	Vial H2SO4 preserved	A	NA		5.1	Y	Absent		TOC-5310(28)
L1727204-05D	Plastic 250ml Trizma preserved	B	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)

*Values in parentheses indicate holding time in days

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1727204
Report Date: 08/21/17

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1727204-05E	Plastic 250ml Trizma preserved	B	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1727204-05F	Plastic 250ml Trizma preserved	B	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1727204-05G	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.1	Y	Absent		A2-14DIOXANE-522(28)
L1727204-05H	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.1	Y	Absent		A2-14DIOXANE-522(28)
L1727204-06A	Vial H2SO4 preserved	A	NA		5.1	Y	Absent		TOC-5310(28)
L1727204-06B	Vial H2SO4 preserved	A	NA		5.1	Y	Absent		TOC-5310(28)
L1727204-06C	Vial H2SO4 preserved	A	NA		5.1	Y	Absent		TOC-5310(28)
L1727204-06D	Plastic 250ml Trizma preserved	B	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1727204-06E	Plastic 250ml Trizma preserved	B	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1727204-06F	Plastic 250ml Trizma preserved	B	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1727204-06G	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.1	Y	Absent		A2-14DIOXANE-522(28)
L1727204-06H	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.1	Y	Absent		A2-14DIOXANE-522(28)

*Values in parentheses indicate holding time in days

Project Name:	MAHER WELLS	**Lab Number:**	L1727204
Project Number:	20107	**Report Date:**	08/21/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	MAHER WELLS	**Lab Number:**	L1727204
Project Number:	20107	**Report Date:**	08/21/17

Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name:	MAHER WELLS	**Lab Number:**	L1727204
Project Number:	20107	**Report Date:**	08/21/17

REFERENCES

19 Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

120 Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography/Mass Spectrometry (GC/MS) with Selected Ion Monitoring (SIM). EPA Method 522, EPA/600/R-08/101. Version 1.0, September 2008.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

122 Determination of Selected Perfluorintated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). EPA Method 537, EPA/600/R-08/092. Version 1.1, September 2009.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

MANSFIELD CHAIN OF CUSTODY

PAGE_____ OF _____

ALPHA ANALYTICAL
WESTBORO, MA TEL: 508-898-9220 FAX: 508-898-9193
MANSFIELD, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab: 8/4/17

ALPHA Job #: L1727204 ~~L1729CS~~

Client Information

Client: Blueleaf Inc
Address: 57 Dresser Hill Rd
Charlton, MA 01507
Phone: (508) 248-7094
Fax:
Email: egrotton@blueleafwater.com
☐ These samples have been previously analyzed by Alpha

Project Information

Project Name: Maher Wells
Project Location: Barnstable MA
Project #: 20107
Project Manager: Erik Grotton
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)
Date Due: Time:

Report Information - Data Deliverables

☐ FAX ☐ EMAIL
☒ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State /Fed Program	Criteria

Other Project Specific Requirements/Comments/Detection Limits:

PLEASE NOTE
MS/MSD (at unit cost) will be omitted unless you check here: ☐

ANALYSIS: Fe, Mn (Total) | pH, Turb, Alk | Alk | Turb | 1,4-Dioxane | PFOC/PFOA | TOC

SAMPLE HANDLING
Filtration
☐ Done
☐ Not needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Fe, Mn (Total)	pH, Turb, Alk	Alk	Turb	1,4-Dioxane	PFOC/PFOA	TOC	Sample Specific Comments	TOTAL # BOTTLES
27204-01	Raw 4	8/4/17	10:00	DW	CAW	1	1			2	3			7
-02	Filter A4	↓	↓	↓	↓	1		1	1					3
-03	Filter C4					1		1	1					3
-04	UV Eff 4									2	3			5
-05	Filter E4									2	3	2		~~8~~ 7
-06	Filter F4									2	3	2		~~8~~ 7

Container Type	P	P	P	P	A	P	A
Preservative	C	A	A	A	O	O	D

Relinquished By:	Date/Time	Received By:	Date/Time
	8/4/17 1702		8/4/17 1702

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

ANALYTICAL REPORT

Lab Number:	L1727347
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Erik Grotton
Phone:	(508) 248-7094
Project Name:	MAHER WELL PILOT
Project Number:	20107
Report Date:	08/23/17

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1727347
Report Date: 08/23/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1727347-01	RAW-5	DW	BARNSTABLE, MA	08/07/17 11:30	08/07/17
L1727347-02	TROJAN-5	DW	BARNSTABLE, MA	08/07/17 11:30	08/07/17
L1727347-03	FILTER-E-5	DW	BARNSTABLE, MA	08/07/17 11:30	08/07/17
L1727347-04	FILTER-F-5	DW	BARNSTABLE, MA	08/07/17 11:30	08/07/17
L1727347-05	FIELD BLANK	WATER	BARNSTABLE, MA	08/07/17 11:30	08/07/17

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1727347
Report Date: 08/23/17

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. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated 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.

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 table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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 Client Service Representative 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 Client Services at 800-624-9220 with any questions.

Project Name: MAHER WELL PILOT **Lab Number:** L1727347
Project Number: 20107 **Report Date:** 08/23/17

Case Narrative (continued)

Report Submission

The analysis of Bromate was subcontracted. A copy of the laboratory report is included as an addendum. Please note: This data is only available in PDF format and is not available on Data Merger.

Sample Receipt

The samples were received at the laboratory above the required temperature range. The samples were transported to the laboratory in a cooler with melted ice and delivered directly from the sampling site.
L1727347-01, -02, -03 and -04: The sample was received above the appropriate pH for the 1,4 Dioxane by EPA 522 analysis.

Perfluorinated Alkyl Acids by EPA 537

L1727347-01: The surrogate recoveries were outside the acceptance criteria for perfluoro-n-[1,2-13c2]hexanoic acid (13c-pfhxa) (15%), perfluoro-n-[1,2-13c2]decanoic acid (13c-pfda) (11%) and n-deuterioethylperfluoro-1-octanesulfonamidoacetic acid (d5-netfosaa) (52%); however, re-extraction achieved similar results. All associated compounds are considered to have a potential bias.
L1727347-02: The surrogate recoveries were outside the acceptance criteria for perfluoro-n-[1,2-13c2]hexanoic acid (13c-pfhxa) (4%), perfluoro-n-[1,2-13c2]decanoic acid (13c-pfda) (3%) and n-deuterioethylperfluoro-1-octanesulfonamidoacetic acid (d5-netfosaa) (32%); however, re-extraction achieved similar results. All associated compounds are considered to have a potential bias.
L1727347-03: The surrogate recoveries were outside the acceptance criteria for perfluoro-n-[1,2-13c2]hexanoic acid (13c-pfhxa) (0%), perfluoro-n-[1,2-13c2]decanoic acid (13c-pfda) (3%) and n-deuterioethylperfluoro-1-octanesulfonamidoacetic acid (d5-netfosaa) (39%); however, re-extraction achieved similar results. All associated compounds are considered to have a potential bias.
L1727347-04: The surrogate recoveries were outside the acceptance criteria for perfluoro-n-[1,2-13c2]hexanoic acid (13c-pfhxa) (15%), perfluoro-n-[1,2-13c2]decanoic acid (13c-pfda) (4%) and n-deuterioethylperfluoro-1-octanesulfonamidoacetic acid (d5-netfosaa) (41%); however, re-extraction achieved similar results. All associated compounds are considered to have a potential bias.
L1727347-05: The surrogate recovery was outside the acceptance criteria; however, re-analysis achieved

Project Name: MAHER WELL PILOT **Lab Number:** L1727347
Project Number: 20107 **Report Date:** 08/23/17

Case Narrative (continued)

similar results: perfluoro-n-[1,2-13c2]decanoic acid (13c-pfda) (146%). The results of the re-analysis are reported; however, all associated compounds are considered to have a potential bias.

The WG1031619-3 LCSD recovery, associated with L1727347-01 through -04, is outside the acceptance criteria for individual target compounds; however, re-analysis achieved similar results. The results of the associated samples are reported; however, all results are considered to have a potentially high bias for perfluorooctanoic acid (pfoa) (133%).

The WG1031620-3 LCSD recovery, associated with L1727347-05, was outside the individual acceptance criteria for perfluorooctanoic acid (pfoa); however, re-analysis achieved a similar result: 133%. The results of the re-analysis are reported; however, all associated compounds are considered to have a potential bias.

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: Kara Lindquist

Title: Technical Director/Representative Date: 08/23/17

ORGANICS

SEMIVOLATILES

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1727347
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1727347-01
Client ID: RAW-5
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/11/17 02:12
Analyst: TJ

Date Collected: 08/07/17 11:30
Date Received: 08/07/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/10/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.594		ug/l	0.144	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	87		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1727347
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1727347-01
Client ID: RAW-5
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/19/17 00:19
Analyst: AR

Date Collected: 08/07/17 11:30
Date Received: 08/07/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.85	--	1
Perfluorooctanesulfonic Acid (PFOS)	86.2		ng/l	1.85	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	**15**	Q	70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**11**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	**52**	Q	70-130

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1727347
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1727347-02
Client ID: TROJAN-5
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/11/17 02:33
Analyst: TJ

Date Collected: 08/07/17 11:30
Date Received: 08/07/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/10/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.144	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	87		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1727347
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1727347-02
Client ID: TROJAN-5
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/19/17 00:28
Analyst: AR

Date Collected: 08/07/17 11:30
Date Received: 08/07/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.85	--	1
Perfluorooctanesulfonic Acid (PFOS)	89.5		ng/l	1.85	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	**4**	Q	70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**3**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	**32**	Q	70-130

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1727347
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1727347-03
Client ID: FILTER-E-5
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/11/17 02:55
Analyst: TJ

Date Collected: 08/07/17 11:30
Date Received: 08/07/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/10/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.214		ug/l	0.144	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	90		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1727347
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1727347-03
Client ID: FILTER-E-5
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/19/17 00:37
Analyst: AR

Date Collected: 08/07/17 11:30
Date Received: 08/07/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.78	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.78	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	**0**	Q	70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**3**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	**39**	Q	70-130

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1727347
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1727347-04
Client ID: FILTER-F-5
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/11/17 03:17
Analyst: TJ

Date Collected: 08/07/17 11:30
Date Received: 08/07/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/10/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.238		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	88		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1727347
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1727347-04
Client ID: FILTER-F-5
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/19/17 00:46
Analyst: AR

Date Collected: 08/07/17 11:30
Date Received: 08/07/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.85	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.85	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	**15**	Q	70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**4**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	**41**	Q	70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1727347
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1727347-05 R
Client ID: FIELD BLANK
Sample Location: BARNSTABLE, MA

Matrix: Water
Analytical Method: 122,537
Analytical Date: 08/19/17 00:56
Analyst: AR

Date Collected: 08/07/17 11:30
Date Received: 08/07/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.85	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.85	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	129		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**146**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	114		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1727347
Report Date: 08/23/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 120,522
Analytical Date: 08/10/17 12:20
Analyst: TJ

Extraction Method: EPA 522
Extraction Date: 08/10/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL
1,4 Dioxane by EPA 522 - Mansfield Lab for sample(s): 01-04 Batch: WG1030897-1					
1,4-Dioxane	ND		ug/l	0.150	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	112		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1727347
Report Date: 08/23/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 122,537
Analytical Date: 08/18/17 22:19
Analyst: AR

Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab for sample(s): 01-04 Batch: WG1031619-1					
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	116		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	123		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	106		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1727347
Report Date: 08/23/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 122,537
Analytical Date: 08/18/17 22:19
Analyst: AR

Extraction Method: EPA 537
Extraction Date: 08/14/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab for sample(s): 05 Batch: WG1031620-1					
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	116		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	123		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	106		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1727347

Report Date: 08/23/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-04 Batch: WG1030897-2 WG1030897-3								
1,4-Dioxane	94		98		70-130	4		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,4-Dioxane-d8	110		111		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1727347

Report Date: 08/23/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01-04 Batch: WG1031619-2 WG1031619-3								
Perfluorooctanoic Acid (PFOA)	128		**133**	Q	70-130	4		30
Perfluorooctanesulfonic Acid (PFOS)	121		123		70-130	2		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	124		**132**	Q	70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**135**	Q	**142**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	122		128		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1727347

Report Date: 08/23/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 05 Batch: WG1031620-2 WG1031620-3								
Perfluorooctanoic Acid (PFOA)	128		**133**	Q	70-130	4		30
Perfluorooctanesulfonic Acid (PFOS)	121		123		70-130	2		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	124		**132**	Q	70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**135**	Q	**142**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	122		128		70-130

Matrix Spike Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1727347

Report Date: 08/23/17

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 - Mansfield Lab	Associated sample(s): 01-04		QC Batch ID: WG1031619-5			QC Sample: L1727204-04			Client ID: MS Sample			
Perfluorooctanoic Acid (PFOA)	16.7	37	67.9	**138**	Q	-	-		70-130	-		30
Perfluorooctanesulfonic Acid (PFOS)	68.9	34.3	117	**140**	Q	-	-		70-130	-		30

Surrogate	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	124				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**151**	Q			70-130
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	125				70-130

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1727347
Report Date: 08/23/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1031619-4 QC Sample: L1727204-01 Client ID: DUP Sample						
Perfluorooctanoic Acid (PFOA)	18.2	18.9	ng/l	4		30
Perfluorooctanesulfonic Acid (PFOS)	87.8	84.8	ng/l	3		30

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	109		123		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	117		126		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	93		95		70-130

METALS

Project Name: MAHER WELL PILOT
Lab Number: L1727347
Project Number: 20107
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1727347-01
Client ID: RAW-5
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/07/17 11:30
Date Received: 08/07/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.080		mg/l	0.050	--	1	08/08/17 10:15	08/10/17 15:03	EPA 3005A	19,200.7	PS
Manganese, Total	0.051		mg/l	0.010	--	1	08/08/17 10:15	08/10/17 15:03	EPA 3005A	19,200.7	PS

Project Name: MAHER WELL PILOT
Lab Number: L1727347
Project Number: 20107
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1727347-02
Client ID: TROJAN-5
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/07/17 11:30
Date Received: 08/07/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.081		mg/l	0.050	--	1	08/08/17 10:15	08/10/17 15:08	EPA 3005A	19,200.7	PS
Manganese, Total	0.053		mg/l	0.010	--	1	08/08/17 10:15	08/10/17 15:08	EPA 3005A	19,200.7	PS

Project Name: MAHER WELL PILOT
Lab Number: L1727347
Project Number: 20107
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1727347-03
Client ID: FILTER-E-5
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/07/17 11:30
Date Received: 08/07/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	08/08/17 10:15	08/10/17 15:13	EPA 3005A	19,200.7	PS
Manganese, Total	0.060		mg/l	0.010	--	1	08/08/17 10:15	08/10/17 15:13	EPA 3005A	19,200.7	PS

Project Name: MAHER WELL PILOT
Lab Number: L1727347
Project Number: 20107
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1727347-04
Client ID: FILTER-F-5
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/07/17 11:30
Date Received: 08/07/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	08/08/17 10:15	08/10/17 15:17	EPA 3005A	19,200.7	PS
Manganese, Total	0.058		mg/l	0.010	--	1	08/08/17 10:15	08/10/17 15:17	EPA 3005A	19,200.7	PS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1727347
Report Date: 08/23/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-04 Batch: WG1029844-1										
Iron, Total	ND		mg/l	0.050	--	1	08/08/17 10:15	08/10/17 12:37	19,200.7	PS
Manganese, Total	ND		mg/l	0.010	--	1	08/08/17 10:15	08/10/17 12:37	19,200.7	PS

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1727347

Report Date: 08/23/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 Batch: WG1029844-2								
Iron, Total	111		-		85-115	-		
Manganese, Total	107		-		85-115	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1727347
Report Date: 08/23/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1029844-3 QC Sample: L1727176-02 Client ID: MS Sample												
Iron, Total	0.863	1	1.99	113		-	-		75-125	-		20
Manganese, Total	0.129	0.5	0.662	107		-	-		75-125	-		20
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1029844-7 QC Sample: L1727337-01 Client ID: MS Sample												
Iron, Total	ND	1	1.16	116		-	-		75-125	-		20
Manganese, Total	ND	0.5	0.555	111		-	-		75-125	-		20

INORGANICS
&
MISCELLANEOUS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1727347
Report Date: 08/23/17

SAMPLE RESULTS

Lab ID: L1727347-01
Client ID: RAW-5
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/07/17 11:30
Date Received: 08/07/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.22		NTU	0.20	--	1	-	08/07/17 23:13	44,180.1	JC
Alkalinity, Total	15.2		mg CaCO3/L	2.00	NA	1	-	08/08/17 09:02	121,2320B	BR
pH (H)	6.0		SU	-	NA	1	-	08/08/17 02:27	121,4500H+-B	VB

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1727347
Report Date: 08/23/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1029718-1										
Turbidity	ND		NTU	0.20	--	1	-	08/07/17 23:13	44,180.1	JC
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1029847-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	08/08/17 09:02	121,2320B	BR

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1727347

Report Date: 08/23/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1029718-2								
Turbidity	100		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1029743-1								
pH	100		-		99-101	-		5
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1029847-2								
Alkalinity, Total	105		-		90-110	-		10

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1727347
Report Date: 08/23/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1029847-4 QC Sample: L1727173-01 Client ID: MS Sample												
Alkalinity, Total	105	100	205	100		-	-		86-116	-		10

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1727347
Report Date: 08/23/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1029718-3 QC Sample: L1727347-01 Client ID: RAW-5						
Turbidity	0.22	0.22	NTU	0		13
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1029743-2 QC Sample: L1727253-01 Client ID: DUP Sample						
pH	7.4	7.3	SU	1		5
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1029847-3 QC Sample: L1727173-01 Client ID: DUP Sample						
Alkalinity, Total	105	103	mg CaCO3/L	2		10

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1727347
Report Date: 08/23/17

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent
B	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1727347-01A	Plastic 250ml unpreserved/No Headspace	B	NA		12.8	Y	Absent		ALK-T-2320(14),TURB-180(2),PH-4500(.01)
L1727347-01B	Plastic 120ml Other preserved (sub-lab)	B	7	7	12.8	Y	Absent		SUB-BROMATE(0)
L1727347-01C	Plastic 120ml HNO3 preserved	B	<2	<2	12.8	Y	Absent		FE-UI(180),MN-UI(180)
L1727347-01D	Amber 500ml NaSulfite/NaHSO4 preserved	B	7	7	12.8	N	Absent		A2-14DIOXANE-522(28)
L1727347-01E	Amber 500ml NaSulfite/NaHSO4 preserved	B	7	7	12.8	N	Absent		A2-14DIOXANE-522(28)
L1727347-01F	Plastic 250ml Trizma preserved	B	NA		12.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1727347-01G	Plastic 250ml Trizma preserved	B	NA		12.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1727347-01H	Plastic 250ml Trizma preserved	B	NA		12.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1727347-02A	Plastic 120ml Other preserved (sub-lab)	B	7	7	12.8	Y	Absent		SUB-BROMATE(0)
L1727347-02B	Plastic 120ml HNO3 preserved	B	<2	<2	12.8	Y	Absent		FE-UI(180),MN-UI(180)
L1727347-02C	Amber 500ml NaSulfite/NaHSO4 preserved	B	7	7	12.8	N	Absent		A2-14DIOXANE-522(28)
L1727347-02D	Amber 500ml NaSulfite/NaHSO4 preserved	B	7	7	12.8	N	Absent		A2-14DIOXANE-522(28)
L1727347-02E	Plastic 250ml Trizma preserved	B	NA		12.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1727347-02F	Plastic 250ml Trizma preserved	B	NA		12.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1727347-02G	Plastic 250ml Trizma preserved	B	NA		12.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1727347-03A	Plastic 120ml Other preserved (sub-lab)	B	7	7	12.8	Y	Absent		SUB-BROMATE(0)
L1727347-03B	Plastic 120ml HNO3 preserved	B	<2	<2	12.8	Y	Absent		FE-UI(180),MN-UI(180)
L1727347-03C	Amber 500ml NaSulfite/NaHSO4 preserved	B	7	7	12.8	N	Absent		A2-14DIOXANE-522(28)
L1727347-03D	Amber 500ml NaSulfite/NaHSO4 preserved	B	7	7	12.8	N	Absent		A2-14DIOXANE-522(28)
L1727347-03E	Plastic 250ml Trizma preserved	B	NA		12.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1727347-03F	Plastic 250ml Trizma preserved	B	NA		12.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1727347-03G	Plastic 250ml Trizma preserved	B	NA		12.8	Y	Absent		A2-537-PFOA/PFOS(14)

*Values in parentheses indicate holding time in days

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1727347
Report Date: 08/23/17

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1727347-04A	Plastic 120ml Other preserved (sub-lab)	B	7	7	12.8	Y	Absent		SUB-BROMATE(0)
L1727347-04B	Plastic 120ml HNO3 preserved	B	<2	<2	12.8	Y	Absent		FE-UI(180),MN-UI(180)
L1727347-04C	Amber 500ml NaSulfite/NaHSO4 preserved	B	7	7	12.8	N	Absent		A2-14DIOXANE-522(28)
L1727347-04D	Amber 500ml NaSulfite/NaHSO4 preserved	B	7	7	12.8	N	Absent		A2-14DIOXANE-522(28)
L1727347-04E	Plastic 250ml Trizma preserved	B	NA		12.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1727347-04F	Plastic 250ml Trizma preserved	B	NA		12.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1727347-04G	Plastic 250ml Trizma preserved	B	NA		12.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1727347-05A	Plastic 250ml Trizma preserved	A	NA		11.2	Y	Absent		A2-537-PFOA/PFOS(14)

*Values in parentheses indicate holding time in days

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1727347
Project Number:	20107	**Report Date:**	08/23/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1727347
Project Number:	20107	**Report Date:**	08/23/17

Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1727347
Project Number:	20107	**Report Date:**	08/23/17

REFERENCES

19 Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

120 Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography/Mass Spectrometry (GC/MS) with Selected Ion Monitoring (SIM). EPA Method 522, EPA/600/R-08/101. Version 1.0, September 2008.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

122 Determination of Selected Perfluorintated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). EPA Method 537, EPA/600/R-08/092. Version 1.1, September 2009.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL
World Class Chemistry

8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

Date Rec'd in Lab: 8/7/17

ALPHA Job #: L1727347

Client Information

Client: Bluelect, Inc.
Address: 57 Dresser Hill Rd
Charlton, MA 01507
Phone: 774 200 8029
Email: egrotton@bluelectwater.com

Additional Project Information:

Project Information

Project Name: Maher Well Pilot
Project Location: Barnstable, MA
Project #: 20107
Project Manager: Erik Grotton
ALPHA Quote #:

Turn-Around Time

☐ Standard ☐ RUSH *(only confirmed if pre-approved!)*

Date Due:

Report Information - Data Deliverables

☐ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program ______ Criteria ______

ANALYSIS

SAMPLE INFO
Filtration
☐ Field
☐ Lab to do
Preservation
☐ Lab to do

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	VOC: ☐8260 ☐624 ☐524.2	SVOC: ☐ABN ☐PAH	METALS: ☐MCP 13 ☐MCP 14 ☐RCP 15	METALS: ☐RCRA5 ☐RCRA8 ☐PP13	EPH: ☐Ranges & Targets ☐ Ranges Only	VPH: ☐Ranges & Targets ☐ Ranges Only	☐PCB ☐PEST	TPH: ☐Quant Only ☐Fingerprint	Total Fe + Mn	Alk, pH, Turb	Bromate	1,4 Dioxane	PFOC/PFOA		Sample Comments	TOTAL # BOTTLES
27347-01	Raw-5	8/7/17	11:30	DW	ARD									X	X	X	X	X			8
-02	Trojan-5	↓	↓	↓	↓									X		X	X	X			7
-03	Filter E-5	↓	↓	↓	↓									X		X	X	X			7
-04	Filter F-5	↓	↓	↓	↓									X		X	X	X			7
-05	Field Blank	↓	↓	↓	↓													X			

Container Type	
Preservative	

Relinquished By:	Date/Time	Received By:	Date/Time
	8/7/17 1842		8/7/17 1842

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

FORM NO: 01-01 (rev. 12-Mar-2012)

RS

SUB UPS: Eurofins, IN

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193
Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #: L1727347

Project Information

Project Name:

Project Location: MA

Project #:

Project Manager: Ethan Leighton

ALPHA Quote #:

Report Information — ☐ FAX ☐ EMAIL ☐ ADEx ☐ Add'l Deliverables

Data Deliverables

Billing Information — ☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program | Criteria

Client Information

Client: Alpha Analytical Lab

Address: 8 Walkup Drive

Westborough, Ma 01581

Phone: 508-898-9220

Fax:

Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☐ No Are MCP Analytical Methods Required?

☐ Yes ☐ No Are CT RCP (Reasonable Confidence Protocols) Required?

Other Project Specific Requirements/Comments/Detection Limits:

Please reference Alpha Job # L1727347 on this report.

ANALYSIS

SAMPLE HANDLING
Filtration
☐ Done
☐ Not Needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Bromate	Sample Specific Comments	TOTAL # BOTTLES
	RAW-5	8/7/17	11 30	DW		X		3
	TROJAN-5	8/7/17	11 30	DW		X		3
	FILTER-E-5	8/7/17	11 30	DW		X		3
	FILTER-F-5	8/7/17	11 30	DW		X		3

Container Type	P		-	-	-	-	-	-	-	-	-	-	
Preservative	T		-	-	-	-	-	-	-	-	-	-	

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

FORM NO: 01-01(I) (rev. 30-JUL-07)

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LABORATORY REPORT

If you have any questions concerning this report, please do not hesitate to call us at (800) 332-4345 or (574) 233-4777.

eurofins | Eaton Analytical

STATE CERTIFICATION LIST

State	Certification	State	Certification
Alabama	40700	Montana	CERT0026
Alaska	IN00035	Nebraska	NE-OS-05-04
Arizona	AZ0432	Nevada	IN00035
Arkansas	IN00035	New Hampshire*	2124
California	2920	New Jersey*	IN598
Colorado	IN035	New Mexico	IN00035
Colorado Radiochemistry	IN035	New York*	11398
Connecticut	PH-0132	North Carolina	18700
Delaware	IN035	North Dakota	R-035
Florida*	E87775	Ohio	87775
Georgia	929	Oklahoma	D9508
Hawaii	IN035	Oregon (Primary AB)*	4074-001
Idaho	IN00035	Pennsylvania*	68-00466
Illinois*	200001	Puerto Rico	IN00035
Illinois Microbiology	17767	Rhode Island	LAO00343
Indiana Chemistry	C-71-01	South Carolina	95005
Indiana Microbiology	M-76-07	South Dakota	IN00035
Iowa	098	Tennessee	TN02973
Kansas*	E-10233	Texas*	T104704187-15-8
Kentucky	90056	Texas/TCEQ	TX207
Louisiana*	LA170006	Utah*	IN00035
Maine	IN00035	Vermont	VT-8775
Maryland	209	Virginia*	460275
Massachusetts	M-IN035	Washington	C837
Michigan	9926	West Virginia	9927 C
Minnesota*	018-999-338	Wisconsin	999766900
Mississippi	IN035	Wyoming	IN035
Missouri	880		

*NELAP/TNI Recognized Accreditation Bodies

Revision date: 05/15/2017

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LABORATORY CASE NARRATIVE

Client: Alpha Analytical Report #: 395104CN

All method QC was within acceptance limits.

Note: This report was amended on 08/23/17 to report results on EEA generic report format, at the request of the client.

08/23/2017

Authorized Signature Title Date

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110 South Hill Street
South Bend, IN 46617
Tel: (574) 233-4777
Fax: (574) 233-8207
1 800 332 4345

Laboratory Report

Client: Alpha Analytical

Attn: Ethan Leighton
35 Whitney Road
Suite 5
Mahwah, NJ 07430

Report: 395104
Priority: Standard Written
Status: Final
PWS ID: Not Supplied

Sample Information

EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3751821	L1727347-1/Raw-5	317.0	08/07/17 11:30	Client	08/09/17 10:00
3751822	L1727347-2/Trojan-5	317.0	08/07/17 11:30	Client	08/09/17 10:00
3751823	L1727347-3/Filter-E-5	317.0	08/07/17 11:30	Client	08/09/17 10:00
3751824	L1727347-4/Filter-F-5	317.0	08/07/17 11:30	Client	08/09/17 10:00

Report Summary

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call James Van Fleit at (574) 233-4777.

Note: This report may not be reproduced, except in full, without written approval from EEA.

Jim Van Fleit ASM

08/23/2017

Authorized Signature | Title | Date

Client Name: Alpha Analytical
Report #: 395104

Client Name: Alpha Analytical

Report #: 395104

Sampling Point: L1727347-1/Raw-5

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	08/11/17 03:35	3751821

Sampling Point: L1727347-2/Trojan-5

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	08/11/17 04:00	3751822

Sampling Point: L1727347-3/Filter-E-5

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	08/11/17 04:25	3751823

Sampling Point: L1727347-4/Filter-F-5

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	08/11/17 04:50	3751824

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!

Client Name: Alpha Analytical Report #: 395104

Lab Definitions

Continuing Calibration Check Standard (CCC) / Continuing Calibration Verification (CCV) / Initial Calibration Verification Standard (ICV) / Initial Performance Check (IPC) - is a standard containing one or more of the target analytes that is prepared from the same standards used to calibrate the instrument. This standard is used to verify the calibration curve at the beginning of each analytical sequence, and may also be analyzed throughout and at the end of the sequence. The concentration of continuing standards may be varied, when prescribed by the reference method, so that the range of the calibration curve is verified on a regular basis. CCL, CCM, and CCH are the CCC standards at low, mid, and high concentration levels, respectively.

Internal Standards (IS) - are pure compounds with properties similar to the analytes of interest, which are added to field samples or extracts, calibration standards, and quality control standards at a known concentration. They are used to measure the relative responses of the analytes of interest and surrogates in the sample, calibration standard or quality control standard.

Laboratory Duplicate (LD) - is a field sample aliquot taken from the same sample container in the laboratory and analyzed separately using identical procedures. Analysis of laboratory duplicates provides a measure of the precision of the laboratory procedures.

Laboratory Fortified Blank (LFB) / Laboratory Control Sample (LCS) - is an aliquot of reagent water to which known concentrations of the analytes of interest are added. The LFB is analyzed exactly the same as the field samples. LFBs are used to determine whether the method is in control. FBL, FBM, and FBH are the LFB samples at low, mid, and high concentration levels, respectively.

Laboratory Method Blank (LMB) / Laboratory Reagent Blank (LRB) - is a sample of reagent water included in the sample batch analyzed in the same way as the associated field samples. The LMB is used to determine if method analytes or other background contamination have been introduced during the preparation or analytical procedure. The LMB is analyzed exactly the same as the field samples.

Laboratory Trip Blank (LTB) / Field Reagent Blank (FRB) - is a sample of laboratory reagent water placed in a sample container in the laboratory and treated as a field sample, including storage, preservation, and all analytical procedures. The FRB/LTB container follows the collection bottles to and from the collection site, but the FRB/LTB is not opened at any time during the trip. The FRB/LTB is primarily a travel blank used to verify that the samples were not contaminated during shipment.

Matrix Spike Duplicate Sample (MSD) / Laboratory Fortified Sample Matrix Duplicate (LFSMD) - is a sample aliquot taken from the same field sample source as the Matrix Spike Sample to which known quantities of the analytes of interest are added in the laboratory. The MSD is analyzed exactly the same as the field samples. Analysis of the MSD provides a measure of the precision of the laboratory procedures in a specific matrix. SDL, SDM, and SDH / LFSMDL, LFSMDM, and LFSMDH are the MSD or LFSMD at low, mid, and high concentration levels, respectively.

Matrix Spike Sample (MS) / Laboratory Fortified Sample Matrix (LFSM) - is a sample aliquot taken from field sample source to which known quantities of the analytes of interest are added in the laboratory. The MS is analyzed exactly the same as the field samples. The purpose is to demonstrate recovery of the analytes from a sample matrix to determine if the specific matrix contributes bias to the analytical results. MSL, MSM, and MSH / LFSML, LFSMM, and LFSMH are the MS or LFSM at low, mid, and high concentration levels, respectively.

Quality Control Standard (QCS) / Second Source Calibration Verification (SSCV) - is a solution containing known concentrations of the analytes of interest prepared from a source different from the source of the calibration standards. The solution is obtained from a second manufacturer or lot if the lot can be demonstrated by the manufacturer as prepared independently from other lots. The QCS sample is analyzed using the same procedures as field samples. The QCS is used as a check on the calibration standards used in the method on a routine basis.

Reporting Limit Check (RLC) / Initial Calibration Check Standard (ICCS) - is a procedural standard that is analyzed each day to evaluate instrument performance at or below the minimum reporting limit (MRL).

Surrogate Standard (SS) / Surrogate Analyte (SUR) - is a pure compound with properties similar to the analytes of interest, which is highly unlikely to be found in any field sample, that is added to the field samples, calibration standards, blanks and quality control standards before sample preparation. The SS is used to evaluate the efficiency of the sample preparation process.

KD

SUB UPS: Eurofins, IN

324562
3 95104

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193

Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #: L1727347

Project Information

Project Name:

Project Location: MA

Project #:

Project Manager: Ethan Leighton

ALPHA Quote #:

Report Information Data Deliverables

☐ FAX ☐ EMAIL

☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program Criteria

Client Information

Client: Alpha Analytical Lab

Address: 8 Walkup Drive

Westborough, Ma 01581

Phone: 508-898-9220

Fax:

Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☐ No Are MCP Analytical Methods Required?

☐ Yes ☐ No Are CT RCP (Reasonable Confidence Protocols) Required?

Other Project Specific Requirements/Comments/Detection Limits:

Please reference Alpha Job # L1727347 on this report.

wet

ANALYSIS

Client Provided Sample Container

SAMPLE HANDLING

Filtration

☐ Done

☐ Not Needed

☐ Lab to do

Preservation

☐ Lab to do

(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Bromate	Sample Specific Comments	TOTAL # BOTTLES
37515821	RAW-5 L1727347-1	8/7/17	11 30	DW		X		3
822	TROJAN-5 -2	8/7/17	11 30	DW		X		3
823	FILTER-E-5 -3	8/7/17	11 30	DW		X		3
824	FILTER-F-5 -4	8/7/17	11 30	DW		X		3

Container Type	P		-	-	-	-	-	-	-	-	-	
Preservative	T		-	-	-	-	-	-	-	-	-	

Serial_No:08231715:30

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time
	8/8/17	KDenw 8-9-17	1000

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

FORM NO: 01-01(I) (rev. 30-JUL-07)

ANALYTICAL REPORT

Lab Number:	L1728130
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Erik Grotton
Phone:	(508) 248-7094
Project Name:	MAHER WELL PILOT
Project Number:	20107
Report Date:	08/28/17

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1728130
Report Date: 08/28/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1728130-01	RAW-6	DW	BARNSTABLE, MA	08/11/17 09:00	08/11/17
L1728130-02	TROJAN-6	DW	BARNSTABLE, MA	08/11/17 09:00	08/11/17
L1728130-03	FILTER E-6	DW	BARNSTABLE, MA	08/11/17 09:00	08/11/17
L1728130-04	FILTER F-6	DW	BARNSTABLE, MA	08/11/17 09:00	08/11/17
L1728130-05	FIELD BLANK	DW	BARNSTABLE, MA	08/11/17 09:00	08/11/17

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1728130
Report Date: 08/28/17

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. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated 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.

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 table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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 Client Service Representative 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 Client Services at 800-624-9220 with any questions.

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1728130
Project Number:	20107	**Report Date:**	08/28/17

Case Narrative (continued)

Report Submission

The analysis of Bromate was subcontracted. A copy of the laboratory report is included as an addendum.

Please note: This data is only available in PDF format and is not available on Data Merger.

Perfluorinated Alkyl Acids

The WG1034331-2/-3 LCS/LCSD recoveries, associated with L1728130-01 through -05, were outside the acceptance criteria for individual target compounds; however, re-analysis achieved similar results. The results of the re-analysis are reported; however, all results are considered to have a potentially high bias for perfluorooctanoic acid (pfoa) (134%/150%) and perfluorooctanesulfonic acid (pfos) (LCSD at 142%).

The WG1034331-5 MS recovery, performed on L1728130-02, is outside the acceptance criteria for perfluorooctanoic acid (pfoa) (133%).

The surrogate recovery for the WG1034331-4 Laboratory Duplicate, performed on L1728130-01, is outside the acceptance criteria for perfluoro-n-[1,2-13c2]decanoic acid (13c-pfda) (133%). The native sample has acceptable surrogate recoveries, and the duplicate RPDs are within method criteria; therefore, no further action was taken.

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: Michelle M. Morris

Title: Technical Director/Representative Date: 08/28/17

ORGANICS

SEMIVOLATILES

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1728130
Report Date: 08/28/17

SAMPLE RESULTS

Lab ID: L1728130-01
Client ID: RAW-6
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/15/17 15:59
Analyst: WR

Date Collected: 08/11/17 09:00
Date Received: 08/11/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/15/17 10:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.661		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	106		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1728130
Report Date: 08/28/17

SAMPLE RESULTS

Lab ID: L1728130-01
Client ID: RAW-6
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/25/17 09:32
Analyst: AR

Date Collected: 08/11/17 09:00
Date Received: 08/11/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/22/17 18:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	21.3		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	93.4		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	109		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	118		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	105		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1728130
Report Date: 08/28/17

SAMPLE RESULTS

Lab ID: L1728130-02
Client ID: TROJAN-6
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/15/17 16:21
Analyst: WR

Date Collected: 08/11/17 09:00
Date Received: 08/11/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/15/17 10:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.144	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	101		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1728130
Report Date: 08/28/17

SAMPLE RESULTS

Lab ID: L1728130-02
Client ID: TROJAN-6
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/25/17 09:51
Analyst: AR

Date Collected: 08/11/17 09:00
Date Received: 08/11/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/22/17 18:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	21.6		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	99.3		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	104		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	115		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	109		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1728130
Report Date: 08/28/17

SAMPLE RESULTS

Lab ID: L1728130-03
Client ID: FILTER E-6
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/15/17 16:44
Analyst: WR

Date Collected: 08/11/17 09:00
Date Received: 08/11/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/15/17 10:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.411		ug/l	0.144	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	101		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1728130
Report Date: 08/28/17

SAMPLE RESULTS

Lab ID: L1728130-03
Client ID: FILTER E-6
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/25/17 10:09
Analyst: AR

Date Collected: 08/11/17 09:00
Date Received: 08/11/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/22/17 18:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	103		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	112		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	95		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1728130
Report Date: 08/28/17

SAMPLE RESULTS

Lab ID: L1728130-04
Client ID: FILTER F-6
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/16/17 11:52
Analyst: WR

Date Collected: 08/11/17 09:00
Date Received: 08/11/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/15/17 10:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.416		ug/l	0.144	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	102		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1728130
Report Date: 08/28/17

SAMPLE RESULTS

Lab ID: L1728130-04
Client ID: FILTER F-6
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/25/17 10:18
Analyst: AR

Date Collected: 08/11/17 09:00
Date Received: 08/11/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/22/17 18:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.67	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.67	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	111		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	118		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	93		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1728130
Report Date: 08/28/17

SAMPLE RESULTS

Lab ID: L1728130-05
Client ID: FIELD BLANK
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/25/17 10:27
Analyst: AR

Date Collected: 08/11/17 09:00
Date Received: 08/11/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/22/17 18:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.39	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.39	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	106		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	109		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	102		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1728130
Report Date: 08/28/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 120,522
Analytical Date: 08/15/17 11:23
Analyst: WR

Extraction Method: EPA 522
Extraction Date: 08/15/17 10:00

Parameter	Result	Qualifier	Units	RL	MDL
1,4 Dioxane by EPA 522 - Mansfield Lab for sample(s): 01-04 Batch: WG1032071-1					
1,4-Dioxane	ND		ug/l	0.150	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	109		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1728130
Report Date: 08/28/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 122,537
Analytical Date: 08/25/17 09:23
Analyst: AR

Extraction Method: EPA 537
Extraction Date: 08/22/17 18:00

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab for sample(s): 01-05 Batch: WG1034331-1					
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	101		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	105		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	90		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1728130

Report Date: 08/28/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-04 Batch: WG1032071-2 WG1032071-3								
1,4-Dioxane	100		99		70-130	1		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,4-Dioxane-d8	112		109		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1728130

Report Date: 08/28/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01-05 Batch: WG1034331-2 WG1034331-3								
Perfluorooctanoic Acid (PFOA)	**134**	Q	**150**	Q	70-130	11		30
Perfluorooctanesulfonic Acid (PFOS)	126		**142**	Q	70-130	12		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	119		117		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	114		121		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	106		106		70-130

Matrix Spike Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1728130
Report Date: 08/28/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1032071-5 QC Sample: L1728130-02 Client ID: TROJAN-6												
1,4-Dioxane	ND	0.962	0.850	88		-	-		70-130	-		30

Surrogate	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
1,4-Dioxane-d8	90				70-130

Matrix Spike Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1728130

Report Date: 08/28/17

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 - Mansfield Lab	Associated sample(s): 01-05		QC Batch ID: WG1034331-5			QC Sample: L1728130-02			Client ID: TROJAN-6			
Perfluorooctanoic Acid (PFOA)	21.6	34.5	67.5	**133**	Q	-	-		70-130	-		30
Perfluorooctanesulfonic Acid (PFOS)	99.3	31.9	134	109		-	-		70-130	-		30

Surrogate	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	102				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	117				70-130
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	110				70-130

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1728130
Report Date: 08/28/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1032071-4 QC Sample: L1728130-01 Client ID: RAW-6						
1,4-Dioxane	0.661	0.534	ug/l	21		30

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	106		85		70-130

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1728130
Report Date: 08/28/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01-05 QC Batch ID: WG1034331-4 QC Sample: L1728130-01 Client ID: RAW-6						
Perfluorooctanoic Acid (PFOA)	21.3	23.7	ng/l	11		30
Perfluorooctanesulfonic Acid (PFOS)	93.4	98.4	ng/l	5		30

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	109		122		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	**118**		**133**	Q	70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	105		113		70-130

METALS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1728130
Report Date: 08/28/17

SAMPLE RESULTS

Lab ID: L1728130-01
Client ID: RAW-6
Sample Location: BARNSTABLE, MA
Matrix: Dw
Date Collected: 08/11/17 09:00
Date Received: 08/11/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.057		mg/l	0.050	--	1	08/14/17 16:30	08/15/17 16:09	EPA 3005A	19,200.7	AB
Manganese, Total	0.050		mg/l	0.010	--	1	08/14/17 16:30	08/15/17 16:09	EPA 3005A	19,200.7	AB

Project Name: MAHER WELL PILOT
Lab Number: L1728130
Project Number: 20107
Report Date: 08/28/17

SAMPLE RESULTS

Lab ID: L1728130-02
Client ID: TROJAN-6
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/11/17 09:00
Date Received: 08/11/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.057		mg/l	0.050	--	1	08/14/17 16:30	08/15/17 16:27	EPA 3005A	19,200.7	AB
Manganese, Total	0.050		mg/l	0.010	--	1	08/14/17 16:30	08/15/17 16:27	EPA 3005A	19,200.7	AB

Project Name: MAHER WELL PILOT
Lab Number: L1728130
Project Number: 20107
Report Date: 08/28/17

SAMPLE RESULTS

Lab ID: L1728130-03
Client ID: FILTER E-6
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/11/17 09:00
Date Received: 08/11/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	08/14/17 16:30	08/15/17 16:32	EPA 3005A	19,200.7	AB
Manganese, Total	0.052		mg/l	0.010	--	1	08/14/17 16:30	08/15/17 16:32	EPA 3005A	19,200.7	AB

Project Name: MAHER WELL PILOT
Lab Number: L1728130
Project Number: 20107
Report Date: 08/28/17

SAMPLE RESULTS

Lab ID: L1728130-04
Client ID: FILTER F-6
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/11/17 09:00
Date Received: 08/11/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	08/14/17 16:30	08/15/17 16:37	EPA 3005A	19,200.7	AB
Manganese, Total	0.053		mg/l	0.010	--	1	08/14/17 16:30	08/15/17 16:37	EPA 3005A	19,200.7	AB

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1728130
Report Date: 08/28/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-04 Batch: WG1031804-1										
Iron, Total	ND		mg/l	0.050	--	1	08/14/17 16:30	08/15/17 15:32	19,200.7	AB
Manganese, Total	ND		mg/l	0.010	--	1	08/14/17 16:30	08/15/17 15:32	19,200.7	AB

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1728130

Report Date: 08/28/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 Batch: WG1031804-2								
Iron, Total	109		-		85-115	-		
Manganese, Total	101		-		85-115	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1728130
Report Date: 08/28/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1031804-3 QC Sample: L1728111-01 Client ID: MS Sample												
Iron, Total	0.231	1	1.29	106		-	-		75-125	-		20
Manganese, Total	0.035	0.5	0.541	101		-	-		75-125	-		20
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1031804-7 QC Sample: L1728163-01 Client ID: MS Sample												
Iron, Total	0.069	1	1.17	110		-	-		75-125	-		20
Manganese, Total	ND	0.5	0.518	104		-	-		75-125	-		20

INORGANICS
&
MISCELLANEOUS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1728130
Report Date: 08/28/17

SAMPLE RESULTS

Lab ID: L1728130-01
Client ID: RAW-6
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/11/17 09:00
Date Received: 08/11/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	ND		NTU	0.20	--	1	-	08/12/17 04:33	44,180.1	VB
Alkalinity, Total	14.4		mg CaCO3/L	2.00	NA	1	-	08/12/17 03:30	121,2320B	VB
pH (H)	6.2		SU	-	NA	1	-	08/12/17 03:05	121,4500H+-B	VB

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1728130
Report Date: 08/28/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1031349-1										
Turbidity	ND		NTU	0.20	--	1	-	08/12/17 04:33	44,180.1	VB
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1031355-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	08/12/17 03:30	121,2320B	VB

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1728130

Report Date: 08/28/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1031335-1								
pH	100		-		99-101	-		5
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1031349-2								
Turbidity	96		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1031355-2								
Alkalinity, Total	106		-		90-110	-		10

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1728130
Report Date: 08/28/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1031355-4 QC Sample: L1728130-01 Client ID: RAW-6												
Alkalinity, Total	14.4	100	112	98		-	-		86-116	-		10

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1728130
Report Date: 08/28/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1031335-2 QC Sample: L1728194-01 Client ID: DUP Sample						
pH	6.8	6.8	SU	0		5
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1031349-3 QC Sample: L1728116-01 Client ID: DUP Sample						
Turbidity	5.4	5.2	NTU	4		13
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1031355-3 QC Sample: L1728130-01 Client ID: RAW-6						
Alkalinity, Total	14.4	14.3	mg CaCO3/L	1		10

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1728130
Report Date: 08/28/17

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent
B	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1728130-01A	Plastic 120ml HNO3 preserved	A	<2	<2	5.3	Y	Absent		FE-UI(180),MN-UI(180)
L1728130-01B	Plastic 120ml Other preserved (sub-lab)	A	7	7	5.3	Y	Absent		SUB-BROMATE(0)
L1728130-01C	Plastic 250ml unpreserved/No Headspace	B	NA		3.5	Y	Absent		ALK-T-2320(14),TURB-180(2),PH-4500(.01)
L1728130-01D	Plastic 250ml Trizma preserved	A	NA		5.3	Y	Absent		A2-537-PFOA/PFOS(14)
L1728130-01E	Plastic 250ml Trizma preserved	A	NA		5.3	Y	Absent		A2-537-PFOA/PFOS(14)
L1728130-01F	Plastic 250ml Trizma preserved	A	NA		5.3	Y	Absent		A2-537-PFOA/PFOS(14)
L1728130-01G	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.3	Y	Absent		A2-14DIOXANE-522(28)
L1728130-01H	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.3	Y	Absent		A2-14DIOXANE-522(28)
L1728130-02A	Plastic 120ml HNO3 preserved	A	<2	<2	5.3	Y	Absent		FE-UI(180),MN-UI(180)
L1728130-02B	Plastic 120ml Other preserved (sub-lab)	A	7	7	5.3	Y	Absent		SUB-BROMATE(0)
L1728130-02D	Plastic 250ml Trizma preserved	A	NA		5.3	Y	Absent		A2-537-PFOA/PFOS(14)
L1728130-02E	Plastic 250ml Trizma preserved	A	NA		5.3	Y	Absent		A2-537-PFOA/PFOS(14)
L1728130-02F	Plastic 250ml Trizma preserved	A	NA		5.3	Y	Absent		A2-537-PFOA/PFOS(14)
L1728130-02G	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.3	Y	Absent		A2-14DIOXANE-522(28)
L1728130-02H	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.3	Y	Absent		A2-14DIOXANE-522(28)
L1728130-03A	Plastic 120ml HNO3 preserved	A	<2	<2	5.3	Y	Absent		FE-UI(180),MN-UI(180)
L1728130-03B	Plastic 120ml Other preserved (sub-lab)	A	7	7	5.3	Y	Absent		SUB-BROMATE(0)
L1728130-03D	Plastic 250ml Trizma preserved	A	NA		5.3	Y	Absent		A2-537-PFOA/PFOS(14)
L1728130-03E	Plastic 250ml Trizma preserved	A	NA		5.3	Y	Absent		A2-537-PFOA/PFOS(14)
L1728130-03F	Plastic 250ml Trizma preserved	A	NA		5.3	Y	Absent		A2-537-PFOA/PFOS(14)
L1728130-03G	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.3	Y	Absent		A2-14DIOXANE-522(28)
L1728130-03H	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.3	Y	Absent		A2-14DIOXANE-522(28)

*Values in parentheses indicate holding time in days

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1728130
Report Date: 08/28/17

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1728130-04A	Plastic 120ml HNO3 preserved	A	<2	<2	5.3	Y	Absent		FE-UI(180),MN-UI(180)
L1728130-04B	Plastic 120ml Other preserved (sub-lab)	A	7	7	5.3	Y	Absent		SUB-BROMATE(0)
L1728130-04D	Plastic 250ml Trizma preserved	A	NA		5.3	Y	Absent		A2-537-PFOA/PFOS(14)
L1728130-04E	Plastic 250ml Trizma preserved	A	NA		5.3	Y	Absent		A2-537-PFOA/PFOS(14)
L1728130-04F	Plastic 250ml Trizma preserved	A	NA		5.3	Y	Absent		A2-537-PFOA/PFOS(14)
L1728130-04G	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.3	Y	Absent		A2-14DIOXANE-522(28)
L1728130-04H	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.3	Y	Absent		A2-14DIOXANE-522(28)
L1728130-05A	Plastic 250ml Trizma preserved	B	NA		3.5	Y	Absent		A2-537-PFOA/PFOS(14)

*Values in parentheses indicate holding time in days

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1728130
Project Number:	20107	**Report Date:**	08/28/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1728130
Project Number:	20107	**Report Date:**	08/28/17

Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1728130
Project Number:	20107	**Report Date:**	08/28/17

REFERENCES

19 Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

120 Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography/Mass Spectrometry (GC/MS) with Selected Ion Monitoring (SIM). EPA Method 522, EPA/600/R-08/101. Version 1.0, September 2008.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

122 Determination of Selected Perfluorintated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). EPA Method 537, EPA/600/R-08/092. Version 1.1, September 2009.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

Serial_No:08281712:34

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 8/11/17

ALPHA Job #: L1728130

ALPHA ANALYTICAL — World Class Chemistry

8 Walkup Drive, Westboro, MA 01581, Tel: 508-898-9220
320 Forbes Blvd, Mansfield, MA 02048, Tel: 508-822-9300

Project Information

Project Name: Maher Well Pilot
Project Location: Barnstable, MA
Project #: 20107
Project Manager: Erik Gotton
ALPHA Quote #:

Report Information - Data Deliverables

☐ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info PO #:

Client Information

Client: Bluleaf, Inc.
Address: 57 Dresser Hill Rd. Charlton, MA 01507
Phone: 774 200 8029
Email: egrotton@bluleafwater.com

Additional Project Information:

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program ______ Criteria ______

Turn-Around Time

☐ Standard ☐ RUSH *(only confirmed if pre-approved!)*

Date Due:

ANALYSIS

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	VOC: ☐ 8260 ☐ 624 ☐ 524.2	SVOC: ☐ ABN ☐ PAH	METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15	METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13	EPH: ☐ Ranges & Targets ☐ Ranges Only	VPH: ☐ Ranges & Targets ☐ Ranges Only	☐ PCB ☐ PEST	TPH: ☐ Quant Only ☐ Fingerprint	Total Fe + Mn	Alk, pH, Turbidity	Bromate	1,4 Dioxane	PFOC/PFOA	Sample Comments	TOTAL # BOTTLES
28130-01	Raw-6	8/11/17	9:00	DW	ARD									X	X	X	X	X		8
02	Trojan-6	↓	↓	↓	↓									X		X	X	X		7
03	Filter E-6	↓	↓	↓	↓									X		X	X	X		7
04	Filter F-6	↓	↓	↓	↓									X		X	X	X		7
05	Field Blank	↓	↓	↓	↓													X		1

SAMPLE INFO
Filtration
☐ Field
☐ Lab to do
Preservation
☐ Lab to do

Container Type
Preservative

Container Type	*Preservative*
P= Plastic	A= None
A= Amber glass	B= HCl
V= Vial	C= HNO_3
G= Glass	D= H_2SO_4
B= Bacteria cup	E= NaOH
C= Cube	F= MeOH
O= Other	G= $NaHSO_4$
E= Encore	H = $Na_2S_2O_3$
D= BOD Bottle	I= Ascorbic Acid
	J = NH_4Cl
	K= Zn Acetate
	O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	8/11/17 13:31	[signature] AAL	8/11/17 1331

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO. 01-01 (rev. 12-Mar-2012)

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193

Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Client Information

Client: Alpha Analytical Lab
Address: 8 Walkup Drive
Westborough, Ma 01581
Phone: 508-898-9220
Fax:
Email: subreports@alphalab.com
☐ These samples have been Previously analyzed by Alpha

Project Information

Project Name:
Project Location: MA
Project #:
Project Manager: Ethan Leighton
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

Date Rec'd in Lab:

ALPHA Job #:L1728130

Report Information Data Deliverables

☐ FAX ☐ EMAIL
☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program *Criteria*

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☐ No Are MCP Analytical Methods Required?
☐ Yes ☐ No Are CT RCP (Reasonable Confidence Protocols) Required?

Other Project Specific Requirements/Comments/Detection Limits:
Please reference Alpha Job #L1728130 on this report.

SAMPLE HANDLING
Filtration
☐ Done
☐ Not Needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	ANALYSIS: BROMATE	Sample Specific Comments	TOTAL # BOTTLES
	RAW-6	8/11/17	09:00	DW		x		1
	TROJAN-6	8/11/17	09:00	DW		x		1
	FILTER E-6	8/11/17	09:00	DW		x		1
	FILTER F-6	8/11/17	09:00	DW		x		1

PLEASE ANSWER QUESTIONS ABOVE!

	BROMATE
Container Type	A
Preservative	O

Relinquished By:	Date/Time	Received By:	Date/Time

IS YOUR PROJECT MA MCP or CT RCP?

FORM NO: 01-01(I) (rev. JUL 07)

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

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LABORATORY REPORT

If you have any questions concerning this report, please do not hesitate to call us at (800) 332-4345 or (574) 233-4777.

eurofins | Eaton Analytical

STATE CERTIFICATION LIST

State	Certification	State	Certification
Alabama	40700	Montana	CERT0026
Alaska	IN00035	Nebraska	NE-OS-05-04
Arizona	AZ0432	Nevada	IN00035
Arkansas	IN00035	New Hampshire*	2124
California	2920	New Jersey*	IN598
Colorado	IN035	New Mexico	IN00035
Colorado Radiochemistry	IN035	New York*	11398
Connecticut	PH-0132	North Carolina	18700
Delaware	IN035	North Dakota	R-035
Florida*	E87775	Ohio	87775
Georgia	929	Oklahoma	D9508
Hawaii	IN035	Oregon (Primary AB)*	4074-001
Idaho	IN00035	Pennsylvania*	68-00466
Illinois*	200001	Puerto Rico	IN00035
Illinois Microbiology	17767	Rhode Island	LAO00343
Indiana Chemistry	C-71-01	South Carolina	95005
Indiana Microbiology	M-76-07	South Dakota	IN00035
Iowa	098	Tennessee	TN02973
Kansas*	E-10233	Texas*	T104704187-15-8
Kentucky	90056	Texas/TCEQ	TX207
Louisiana*	LA170006	Utah*	IN00035
Maine	IN00035	Vermont	VT-8775
Maryland	209	Virginia*	460275
Massachusetts	M-IN035	Washington	C837
Michigan	9926	West Virginia	9927 C
Minnesota*	018-999-338	Wisconsin	999766900
Mississippi	IN035	Wyoming	IN035
Missouri	880		

*NELAP/TNI Recognized Accreditation Bodies

Revision date: 05/15/2017

eurofins | Eaton Analytical

110 South Hill Street
South Bend, IN 46617
Tel: (574) 233-4777
Fax: (574) 233-8207
1 800 332 4345

Laboratory Report

Client: Alpha Analytical

Attn: Ethan Leighton
35 Whitney Road
Suite 5
Mahwah, NJ 07430

Report: 395883
Priority: Standard Written
Status: Final
PWS ID: Not Supplied

Sample Information

EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3759110	L1728130-1/RAW-6	317.0	08/11/17 09:00	Client	08/17/17 09:45
3759111	L1728130-2/TROJAN-6	317.0	08/11/17 09:00	Client	08/17/17 09:45
3759112	L1728130-3/FILTER E-6	317.0	08/11/17 09:00	Client	08/17/17 09:45
3759113	L1728130-4/FILTER F-6	317.0	08/11/17 09:00	Client	08/17/17 09:45

Report Summary

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call James Van Fleit at (574) 233-4777.

Note: This report may not be reproduced, except in full, without written approval from EEA.

Jim Van Fleit ASM

08/23/2017

Authorized Signature | Title | Date

Client Name: Alpha Analytical
Report #: 395883

Client Name: Alpha Analytical

Report #: 395883

Sampling Point: L1728130-1/RAW-6

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	08/18/17 07:19	3759110

Sampling Point: L1728130-2/TROJAN-6

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	08/18/17 07:44	3759111

Sampling Point: L1728130-3/FILTER E-6

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	08/18/17 08:09	3759112

Sampling Point: L1728130-4/FILTER F-6

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	08/18/17 08:34	3759113

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!

Client Name: Alpha Analytical Report #: 395883

Lab Definitions

Continuing Calibration Check Standard (CCC) / Continuing Calibration Verification (CCV) / Initial Calibration Verification Standard (ICV) / Initial Performance Check (IPC) - is a standard containing one or more of the target analytes that is prepared from the same standards used to calibrate the instrument. This standard is used to verify the calibration curve at the beginning of each analytical sequence, and may also be analyzed throughout and at the end of the sequence. The concentration of continuing standards may be varied, when prescribed by the reference method, so that the range of the calibration curve is verified on a regular basis. CCL, CCM, and CCH are the CCC standards at low, mid, and high concentration levels, respectively.

Internal Standards (IS) - are pure compounds with properties similar to the analytes of interest, which are added to field samples or extracts, calibration standards, and quality control standards at a known concentration. They are used to measure the relative responses of the analytes of interest and surrogates in the sample, calibration standard or quality control standard.

Laboratory Duplicate (LD) - is a field sample aliquot taken from the same sample container in the laboratory and analyzed separately using identical procedures. Analysis of laboratory duplicates provides a measure of the precision of the laboratory procedures.

Laboratory Fortified Blank (LFB) / Laboratory Control Sample (LCS) - is an aliquot of reagent water to which known concentrations of the analytes of interest are added. The LFB is analyzed exactly the same as the field samples. LFBs are used to determine whether the method is in control. FBL, FBM, and FBH are the LFB samples at low, mid, and high concentration levels, respectively.

Laboratory Method Blank (LMB) / Laboratory Reagent Blank (LRB) - is a sample of reagent water included in the sample batch analyzed in the same way as the associated field samples. The LMB is used to determine if method analytes or other background contamination have been introduced during the preparation or analytical procedure. The LMB is analyzed exactly the same as the field samples.

Laboratory Trip Blank (LTB) / Field Reagent Blank (FRB) - is a sample of laboratory reagent water placed in a sample container in the laboratory and treated as a field sample, including storage, preservation, and all analytical procedures. The FRB/LTB container follows the collection bottles to and from the collection site, but the FRB/LTB is not opened at any time during the trip. The FRB/LTB is primarily a travel blank used to verify that the samples were not contaminated during shipment.

Matrix Spike Duplicate Sample (MSD) / Laboratory Fortified Sample Matrix Duplicate (LFSMD) - is a sample aliquot taken from the same field sample source as the Matrix Spike Sample to which known quantities of the analytes of interest are added in the laboratory. The MSD is analyzed exactly the same as the field samples. Analysis of the MSD provides a measure of the precision of the laboratory procedures in a specific matrix. SDL, SDM, and SDH / LFSMDL, LFSMDM, and LFSMDH are the MSD or LFSMD at low, mid, and high concentration levels, respectively.

Matrix Spike Sample (MS) / Laboratory Fortified Sample Matrix (LFSM) - is a sample aliquot taken from field sample source to which known quantities of the analytes of interest are added in the laboratory. The MS is analyzed exactly the same as the field samples. The purpose is to demonstrate recovery of the analytes from a sample matrix to determine if the specific matrix contributes bias to the analytical results. MSL, MSM, and MSH / LFSML, LFSMM, and LFSMH are the MS or LFSM at low, mid, and high concentration levels, respectively.

Quality Control Standard (QCS) / Second Source Calibration Verification (SSCV) - is a solution containing known concentrations of the analytes of interest prepared from a source different from the source of the calibration standards. The solution is obtained from a second manufacturer or lot if the lot can be demonstrated by the manufacturer as prepared independently from other lots. The QCS sample is analyzed using the same procedures as field samples. The QCS is used as a check on the calibration standards used in the method on a routine basis.

Reporting Limit Check (RLC) / Initial Calibration Check Standard (ICCS) - is a procedural standard that is analyzed each day to evaluate instrument performance at or below the minimum reporting limit (MRL).

Surrogate Standard (SS) / Surrogate Analyte (SUR) - is a pure compound with properties similar to the analytes of interest, which is highly unlikely to be found in any field sample, that is added to the field samples, calibration standards, blanks and quality control standards before sample preparation. The SS is used to evaluate the efficiency of the sample preparation process.

PUB UPS:EUROFINS,IN

325023

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA
TEL: 508-898-9220
FAX: 508-898-9193

Mansfield, MA
TEL: 508-822-9300
FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #:L1728130

Client Information

Client: Alpha Analytical Lab
Address: 8 Walkup Drive
Westborough, Ma 01581
Phone: 508-898-9220
Fax:
Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Project Information

Project Name:
Project Location: MA
Project #:
Project Manager: Ethan Leighton
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

Report Information — Data Deliverables

☐ FAX ☐ EMAIL
☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #: 395883

Regulatory Requirements/Report Limits

State/Fed Program | Criteria

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☐ No Are MCP Analytical Methods Required?
☐ Yes ☐ No Are CT RCP (Reasonable Confidence Protocols) Required?

Other Project Specific Requirements/Comments/Detection Limits:
Please reference Alpha Job #L1728130 on this report.

Wt 1.6 °C

ANALYSIS

SAMPLE HANDLING
Filtration
☐ Done
☐ Not Needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	BROMATE	Sample Specific Comments	TOTAL # BOTTLES
37591 10	RAW-6 L1728130-1	8/11/17	09:00	DW		x		1
11	TROJAN-6 -2	8/11/17	09:00	DW		x		1
12	FILTER E-6 -3	8/11/17	09:00	DW		x		1
13	FILTER F-6 -4	8/11/17	09:00	DW		x		1

Container Type	A		-	-	-	-	-	-	-	-	-	-
Preservative	O		-	-	-	-	-	-	-	-	-	-

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP *or* CT RCP?

FORM NO: 01-01(I) (rev. 30-JUL-07)

Relinquished By:	Date/Time	Received By:	Date/Time
	8/14/17	KDW 8-17-17	0945

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

ANALYTICAL REPORT

Lab Number:	L1729058
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Erik Grotton
Phone:	(508) 248-7094
Project Name:	MAHER WELL PILOT
Project Number:	20107
Report Date:	09/12/17

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1729058
Report Date: 09/12/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1729058-01	RAW-7	DW	BARNSTABLE, MA	08/18/17 09:00	08/18/17
L1729058-02	TROJAN-7	DW	BARNSTABLE, MA	08/18/17 09:00	08/18/17
L1729058-03	FILTER E-7	DW	BARNSTABLE, MA	08/18/17 09:00	08/18/17
L1729058-04	FILTER F-7	DW	BARNSTABLE, MA	08/18/17 09:00	08/18/17
L1729058-05	FIELD BLANK	DW	BARNSTABLE, MA	08/18/17 09:00	08/18/17

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729058
Report Date: 09/12/17

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. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated 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.

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 table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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 Client Service Representative 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 Client Services at 800-624-9220 with any questions.

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729058
Report Date: 09/12/17

Case Narrative (continued)

Report Submission

The analysis of Bromate was subcontracted. A copy of the laboratory report is included as an addendum. Please note: This data is only available in PDF format and is not available on Data Merger.

Sample Receipt

The samples were received at the laboratory above the required temperature range. The samples were transported to the laboratory in a cooler with ice and delivered directly from the sampling site.

Perfluorinated Alkyl Acids

The WG1034748-2/-3 LCS/LCSD recoveries, associated with L1729058-01 through -05, are outside the acceptance criteria for individual target compounds. The results of the associated samples are reported; however, all results are considered to have a potentially high bias for perfluorooctanoic acid (pfoa) (140%/145%) and perfluorooctanesulfonic acid (pfos) (140%/140%).

The WG1034748-5 MS recovery, performed on L1729058-02, is outside the acceptance criteria for perfluorooctanoic acid (pfoa) (135%).

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: Kara Lindquist

Title: Technical Director/Representative Date: 09/12/17

ORGANICS

SEMIVOLATILES

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729058
Report Date: 09/12/17

SAMPLE RESULTS

Lab ID: L1729058-01
Client ID: RAW-7
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/23/17 19:17
Analyst: TJ

Date Collected: 08/18/17 09:00
Date Received: 08/18/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/23/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.518		ug/l	0.144	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	94		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729058
Report Date: 09/12/17

SAMPLE RESULTS

Lab ID: L1729058-01
Client ID: RAW-7
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/25/17 11:23
Analyst: AR

Date Collected: 08/18/17 09:00
Date Received: 08/18/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/23/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	20.5		ng/l	1.78	--	1
Perfluorooctanesulfonic Acid (PFOS)	82.3		ng/l	1.78	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	106		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	117		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	111		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729058
Report Date: 09/12/17

SAMPLE RESULTS

Lab ID: L1729058-02
Client ID: TROJAN-7
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/23/17 19:39
Analyst: TJ

Date Collected: 08/18/17 09:00
Date Received: 08/18/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/23/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.144	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	97		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729058
Report Date: 09/12/17

SAMPLE RESULTS

Lab ID: L1729058-02
Client ID: TROJAN-7
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/25/17 11:41
Analyst: AR

Date Collected: 08/18/17 09:00
Date Received: 08/18/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/23/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	22.0		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	87.9		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	97		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	105		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	96		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729058
Report Date: 09/12/17

SAMPLE RESULTS

Lab ID: L1729058-03
Client ID: FILTER E-7
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/23/17 20:02
Analyst: TJ

Date Collected: 08/18/17 09:00
Date Received: 08/18/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/23/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.204		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	98		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729058
Report Date: 09/12/17

SAMPLE RESULTS

Lab ID: L1729058-03
Client ID: FILTER E-7
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/25/17 11:59
Analyst: AR

Date Collected: 08/18/17 09:00
Date Received: 08/18/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/23/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	109		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	122		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	103		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729058
Report Date: 09/12/17

SAMPLE RESULTS

Lab ID: L1729058-04
Client ID: FILTER F-7
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 08/23/17 20:25
Analyst: TJ

Date Collected: 08/18/17 09:00
Date Received: 08/18/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 08/23/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.209		ug/l	0.144	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	95		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729058
Report Date: 09/12/17

SAMPLE RESULTS

Lab ID: L1729058-04
Client ID: FILTER F-7
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/25/17 12:09
Analyst: AR

Date Collected: 08/18/17 09:00
Date Received: 08/18/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/23/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.78	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.78	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	115		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	127		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	119		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729058
Report Date: 09/12/17

SAMPLE RESULTS

Lab ID: L1729058-05
Client ID: FIELD BLANK
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 08/25/17 12:18
Analyst: AR

Date Collected: 08/18/17 09:00
Date Received: 08/18/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/23/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	105		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	114		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	106		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729058
Report Date: 09/12/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 120,522
Analytical Date: 08/23/17 06:15
Analyst: TJ

Extraction Method: EPA 522
Extraction Date: 08/23/17 06:00

Parameter	Result	Qualifier	Units	RL	MDL
1,4 Dioxane by EPA 522 - Mansfield Lab for sample(s): 01-04 Batch: WG1034633-1					
1,4-Dioxane	ND		ug/l	0.150	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	104		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729058
Report Date: 09/12/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 122,537
Analytical Date: 08/25/17 11:13
Analyst: AR

Extraction Method: EPA 537
Extraction Date: 08/23/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab for sample(s): 01-05 Batch: WG1034748-1					
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	103		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	108		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	108		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1729058

Report Date: 09/12/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-04 Batch: WG1034633-2 WG1034633-3								
1,4-Dioxane	92		95		70-130	3		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,4-Dioxane-d8	107		109		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1729058

Report Date: 09/12/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01-05 Batch: WG1034748-2 WG1034748-3								
Perfluorooctanoic Acid (PFOA)	**140**	Q	**145**	Q	70-130	4		30
Perfluorooctanesulfonic Acid (PFOS)	**140**	Q	**140**	Q	70-130	0		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	101		103		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	111		110		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	105		112		70-130

Matrix Spike Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1729058

Report Date: 09/12/17

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 - Mansfield Lab	Associated sample(s): 01-05		QC Batch ID: WG1034748-5			QC Sample: L1729058-02			Client ID: TROJAN-7			
Perfluorooctanoic Acid (PFOA)	22.0	34.5	68.7	**135**	Q	-	-		70-130	-		30
Perfluorooctanesulfonic Acid (PFOS)	87.9	31.9	129	129		-	-		70-130	-		30

Surrogate	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	105				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	116				70-130
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	103				70-130

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1729058
Report Date: 09/12/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01-05 QC Batch ID: WG1034748-4 QC Sample: L1729058-01 Client ID: RAW-7						
Perfluorooctanoic Acid (PFOA)	20.5	20.3	ng/l	1		30
Perfluorooctanesulfonic Acid (PFOS)	82.3	81.3	ng/l	1		30

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	106		109		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	117		119		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	111		103		70-130

METALS

Project Name: MAHER WELL PILOT
Lab Number: L1729058
Project Number: 20107
Report Date: 09/12/17

SAMPLE RESULTS

Lab ID: L1729058-01
Client ID: RAW-7
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/18/17 09:00
Date Received: 08/18/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.062		mg/l	0.050	--	1	08/22/17 10:00	08/22/17 22:32	EPA 3005A	19,200.7	PS
Manganese, Total	0.050		mg/l	0.010	--	1	08/22/17 10:00	08/22/17 22:32	EPA 3005A	19,200.7	PS

Project Name: MAHER WELL PILOT
Lab Number: L1729058
Project Number: 20107
Report Date: 09/12/17

SAMPLE RESULTS

Lab ID: L1729058-02
Client ID: TROJAN-7
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/18/17 09:00
Date Received: 08/18/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.072		mg/l	0.050	--	1	08/22/17 10:00	08/22/17 22:36	EPA 3005A	19,200.7	PS
Manganese, Total	0.051		mg/l	0.010	--	1	08/22/17 10:00	08/22/17 22:36	EPA 3005A	19,200.7	PS

Project Name: MAHER WELL PILOT
Lab Number: L1729058
Project Number: 20107
Report Date: 09/12/17

SAMPLE RESULTS

Lab ID: L1729058-03
Client ID: FILTER E-7
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/18/17 09:00
Date Received: 08/18/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	08/22/17 10:00	08/22/17 22:40	EPA 3005A	19,200.7	PS
Manganese, Total	0.052		mg/l	0.010	--	1	08/22/17 10:00	08/22/17 22:40	EPA 3005A	19,200.7	PS

Project Name: MAHER WELL PILOT
Lab Number: L1729058
Project Number: 20107
Report Date: 09/12/17

SAMPLE RESULTS

Lab ID: L1729058-04
Client ID: FILTER F-7
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/18/17 09:00
Date Received: 08/18/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	08/22/17 10:00	08/22/17 22:56	EPA 3005A	19,200.7	PS
Manganese, Total	0.051		mg/l	0.010	--	1	08/22/17 10:00	08/22/17 22:56	EPA 3005A	19,200.7	PS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729058
Report Date: 09/12/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-04 Batch: WG1034149-1										
Iron, Total	ND		mg/l	0.050	--	1	08/22/17 10:00	08/22/17 21:10	19,200.7	PS
Manganese, Total	ND		mg/l	0.010	--	1	08/22/17 10:00	08/22/17 21:10	19,200.7	PS

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1729058

Report Date: 09/12/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 Batch: WG1034149-2								
Iron, Total	111		-		85-115	-		
Manganese, Total	105		-		85-115	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729058
Report Date: 09/12/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1034149-3 QC Sample: L1729109-01 Client ID: MS Sample												
Iron, Total	ND	1	1.16	116		-	-		75-125	-		20
Manganese, Total	0.010	0.5	0.538	106		-	-		75-125	-		20
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1034149-7 QC Sample: L1729308-01 Client ID: MS Sample												
Iron, Total	8.67	1	9.50	83		-	-		75-125	-		20
Manganese, Total	2.27	0.5	2.72	90		-	-		75-125	-		20

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1729058
Report Date: 09/12/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1034149-8 QC Sample: L1729308-01 Client ID: DUP Sample						
Iron, Total	8.67	8.89	mg/l	3		20

INORGANICS
&
MISCELLANEOUS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729058
Report Date: 09/12/17

SAMPLE RESULTS

Lab ID: L1729058-01
Client ID: RAW-7
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/18/17 09:00
Date Received: 08/18/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.22		NTU	0.20	--	1	-	08/19/17 01:09	44,180.1	VB
Alkalinity, Total	13.1		mg CaCO3/L	2.00	NA	1	-	08/19/17 01:05	121,2320B	VB
pH (H)	6.2		SU	-	NA	1	-	08/19/17 08:01	121,4500H+-B	VB

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729058
Report Date: 09/12/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1033535-1										
Turbidity	ND		NTU	0.20	--	1	-	08/19/17 01:09	44,180.1	VB
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1033537-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	08/19/17 01:05	121,2320B	VB

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1729058

Report Date: 09/12/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1033534-1								
pH	100		-		99-101	-		5
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1033535-2								
Turbidity	99		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1033537-2								
Alkalinity, Total	107		-		90-110	-		10

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1729058
Report Date: 09/12/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1033537-4 QC Sample: L1729058-01 Client ID: RAW-7												
Alkalinity, Total	13.1	100	113	100		-	-		86-116	-		10

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1729058
Report Date: 09/12/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1033534-2 QC Sample: L1729058-01 Client ID: RAW-7						
pH (H)	6.2	6.2	SU	0		5
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1033535-3 QC Sample: L1729058-01 Client ID: RAW-7						
Turbidity	0.22	0.20	NTU	10		13
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1033537-3 QC Sample: L1729058-01 Client ID: RAW-7						
Alkalinity, Total	13.1	13.2	mg CaCO3/L	1		10

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1729058
Report Date: 09/12/17

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent
B	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1729058-01A	Plastic 120ml HNO3 preserved	B	<2	<2	7.8	Y	Absent		FE-UI(180),MN-UI(180)
L1729058-01B	Plastic 120ml Other preserved (sub-lab)	B	7	7	7.8	Y	Absent		SUB-BROMATE(0)
L1729058-01C	Plastic 250ml unpreserved/No Headspace	B	NA		7.8	Y	Absent		ALK-T-2320(14),TURB-180(2),PH-4500(.01)
L1729058-01D	Plastic 250ml Trizma preserved	B	NA		7.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1729058-01E	Plastic 250ml Trizma preserved	B	NA		7.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1729058-01F	Plastic 250ml Trizma preserved	B	NA		7.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1729058-01G	Amber 500ml NaSulfite/NaHSO4 preserved	B	<4	<4	7.8	Y	Absent		A2-14DIOXANE-522(28)
L1729058-01H	Amber 500ml NaSulfite/NaHSO4 preserved	B	<4	<4	7.8	Y	Absent		A2-14DIOXANE-522(28)
L1729058-02A	Plastic 120ml HNO3 preserved	B	<2	<2	7.8	Y	Absent		FE-UI(180),MN-UI(180)
L1729058-02B	Plastic 120ml Other preserved (sub-lab)	B	7	7	7.8	Y	Absent		SUB-BROMATE(0)
L1729058-02D	Plastic 250ml Trizma preserved	B	NA		7.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1729058-02E	Plastic 250ml Trizma preserved	B	NA		7.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1729058-02F	Plastic 250ml Trizma preserved	B	NA		7.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1729058-02G	Amber 500ml NaSulfite/NaHSO4 preserved	B	<4	<4	7.8	Y	Absent		A2-14DIOXANE-522(28)
L1729058-02H	Amber 500ml NaSulfite/NaHSO4 preserved	B	<4	<4	7.8	Y	Absent		A2-14DIOXANE-522(28)
L1729058-03A	Plastic 120ml HNO3 preserved	B	<2	<2	7.8	Y	Absent		FE-UI(180),MN-UI(180)
L1729058-03B	Plastic 120ml Other preserved (sub-lab)	B	7	7	7.8	Y	Absent		SUB-BROMATE(0)
L1729058-03D	Plastic 250ml Trizma preserved	B	NA		7.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1729058-03E	Plastic 250ml Trizma preserved	B	NA		7.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1729058-03F	Plastic 250ml Trizma preserved	B	NA		7.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1729058-03G	Amber 500ml NaSulfite/NaHSO4 preserved	B	<4	<4	7.8	Y	Absent		A2-14DIOXANE-522(28)
L1729058-03H	Amber 500ml NaSulfite/NaHSO4 preserved	B	<4	<4	7.8	Y	Absent		A2-14DIOXANE-522(28)

*Values in parentheses indicate holding time in days

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1729058
Report Date: 09/12/17

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1729058-04A	Plastic 120ml HNO3 preserved	B	<2	<2	7.8	Y	Absent		FE-UI(180),MN-UI(180)
L1729058-04B	Plastic 120ml Other preserved (sub-lab)	B	7	7	7.8	Y	Absent		SUB-BROMATE(0)
L1729058-04D	Plastic 250ml Trizma preserved	B	NA		7.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1729058-04E	Plastic 250ml Trizma preserved	B	NA		7.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1729058-04F	Plastic 250ml Trizma preserved	B	NA		7.8	Y	Absent		A2-537-PFOA/PFOS(14)
L1729058-04G	Amber 500ml NaSulfite/NaHSO4 preserved	B	<4	<4	7.8	Y	Absent		A2-14DIOXANE-522(28)
L1729058-04H	Amber 500ml NaSulfite/NaHSO4 preserved	B	<4	<4	7.8	Y	Absent		A2-14DIOXANE-522(28)
L1729058-05A	Plastic 250ml Trizma preserved	A	NA		8.9	Y	Absent		A2-537-PFOA/PFOS(14)

*Values in parentheses indicate holding time in days

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1729058
Project Number:	20107	**Report Date:**	09/12/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1729058
Project Number:	20107	**Report Date:**	09/12/17

Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1729058
Project Number:	20107	**Report Date:**	09/12/17

REFERENCES

19 Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

120 Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography/Mass Spectrometry (GC/MS) with Selected Ion Monitoring (SIM). EPA Method 522, EPA/600/R-08/101. Version 1.0, September 2008.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

122 Determination of Selected Perfluorintated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). EPA Method 537, EPA/600/R-08/092. Version 1.1, September 2009.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

ALPHA ANALYTICAL
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8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 8/18/17

ALPHA Job #: L1729058

Client Information

Client: Bluelect, Inc.

Address: 57 Dresser Hill Rd.
Charlton, MA 01507

Phone: 774 200 8029

Email: egrotton@bluelectwater.com

Additional Project Information:

Project Information

Project Name: Maher Well Pilot

Project Location: Barnstable, MA

Project #: 20107

Project Manager: Erik Grotton

ALPHA Quote #:

Turn-Around Time

☐ Standard ☐ RUSH (only confirmed if pre-approved!)

Date Due:

Report Information - Data Deliverables

☐ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program ______ Criteria ______

ANALYSIS

VOC: ☐ 8260 ☐ 624 ☐ 524.2
SVOC: ☐ ABN ☐ PAH
METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15
METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13
EPH: ☐ Ranges & Targets ☐ Ranges Only
VPH: ☐ Ranges & Targets ☐ Ranges Only
☐ PCB ☐ PEST
TPH: ☐ Quant Only ☐ Fingerprint

SAMPLE INFO
Filtration
☐ Field
☐ Lab to do
Preservation
☐ Lab to do

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	VOC	SVOC	METALS	METALS	EPH	VPH	PCB/PEST	TPH	Total Fe + Mn	Alk, pH, Turb	Bromate	1,4 Dioxane	PFOC, PFOA		Sample Comments	TOTAL # BOTTLES
29058 01	Raw - 7	8/18/17	9:00	DW	ARD									X	X	X	X	X			8
02	Trojan - 7	↓	↓	↓	↓									X		X	X	X			7
03	Filter E - 7	↓	↓	↓	↓									X		X	X	X			7
04	Filter F - 7	↓	↓	↓	↓									X		X	X	X			7
05	Field Blank	↓	↓	↓	↓													X			

Container Type	
Preservative	

Container Type	Preservative
P= Plastic	A= None
A= Amber glass	B= HCl
V= Vial	C= HNO_3
G= Glass	D= H_2SO_4
B= Bacteria cup	E= NaOH
C= Cube	F= MeOH
O= Other	G= $NaHSO_4$
E= Encore	H = $Na_2S_2O_3$
D= BOD Bottle	I= Ascorbic Acid
	J = NH_4Cl
	K= Zn Acetate
	O= Other

Relinquished By:	Date/Time		Received By:	Date/Time
[signature]	8/18/17	13:15	[signature]	8/18/17 1315

All samples submitted are subject to Alpha's Terms and Conditions.
See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

SUB UPS: Eurofins, IN

CHAIN OF CUSTODY

ALPHA ANALYTICAL
Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193
Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Client Information

Client: Alpha Analytical Lab
Address: 8 Walkup Drive
Westborough, Ma 01581
Phone: 508-898-9220
Fax:
Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Project Information

Project Name:
Project Location: MA
Project #:
Project Manager: Ethan Leighton
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)
Due Date: Time:

Other Project Specific Requirements/Comments/Detection Limits:
Please reference Alpha Job #L1729058 on this report.

Date Rec'd in Lab:

ALPHA Job #:L1729058

Report Information Data Deliverables

☐ FAX ☐ EMAIL
☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program | Criteria

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☐ No Are MCP Analytical Methods Required?
☐ Yes ☐ No Are CT RCP (Reasonable Confidence Protocols) Required?

ANALYSIS

SAMPLE HANDLING
Filtration
☐ Done
☐ Not Needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	BROMATE	Sample Specific Comments	TOTAL # BOTTLES
	RAW-7	8/18/17	09:00	DW		x		1
	TROJAN-7	8/18/17	09:00	DW		x		1
	FILTER E-7	8/18/17	09:00	DW		x		1
	FILTER F-7	8/18/17	09:00	DW		x		1

Container Type	P		-	-	-	-	-	-	-	-	-	-
Preservative	O		-	-	-	-	-	-	-	-	-	-

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

FORM NO: 01-01(I) (rev. 30-JUL-07)

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LABORATORY REPORT

If you have any questions concerning this report, please do not hesitate to call us at (800) 332-4345 or (574) 233-4777.

eurofins | Eaton Analytical

STATE CERTIFICATION LIST

State	Certification	State	Certification
Alabama	40700	Missouri	880
Alaska	IN00035	Montana	CERT0026
Arizona	AZ0432	Nebraska	NE-OS-05-04
Arkansas	IN00035	Nevada	IN00035
California	2920	New Hampshire*	2124
Colorado	IN035	New Jersey*	IN598
Colorado Radiochemistry	IN035	New Mexico	IN00035
Connecticut	PH-0132	New York*	11398
Delaware	IN035	North Carolina	18700
Florida*	E87775	North Dakota	R-035
Georgia	929	Ohio	87775
Hawaii	IN035	Oklahoma	D9508
Idaho	IN00035	Oregon (Primary AB)*	4074-001
Illinois*	200001	Pennsylvania*	68-00466
Illinois Microbiology	17767	Puerto Rico	IN00035
Illinois Radiochemistry	IN00035	Rhode Island	LAO00343
Indiana Chemistry	C-71-01	South Carolina	95005
Indiana Microbiology	M-76-07	South Dakota	IN00035
Iowa	098	Tennessee	TN02973
Kansas*	E-10233	Texas*	T104704187-15-8
Kentucky	90056	Texas/TCEQ	TX207
Louisiana*	LA170006	Utah*	IN00035
Maine	IN00035	Vermont	VT-8775
Maryland	209	Virginia*	460275
Massachusetts	M-IN035	Washington	C837
Michigan	9926	West Virginia	9927 C
Minnesota*	018-999-338	Wisconsin	999766900
Mississippi	IN035	Wyoming	IN035
EPA	IN00035		

*NELAP/TNI Recognized Accreditation Bodies

Revision date: 08/28/2017

eurofins | Eaton Analytical

110 South Hill Street
South Bend, IN 46617
Tel: (574) 233-4777
Fax: (574) 233-8207
1 800 332 4345

Laboratory Report

Client: Alpha Analytical

Attn: Ethan Leighton
35 Whitney Road
Suite 5
Mahwah, NJ 07430

Report: 396213
Priority: Standard Written
Status: Final
PWS ID: Not Supplied

Sample Information

EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3762640	L1729058 RAW-7	317.0	08/18/17 09:00	Client	08/22/17 09:45
3762641	L1729058 TROJAN-7	317.0	08/18/17 09:00	Client	08/22/17 09:45
3762642	L1729058 FILTER E-7	317.0	08/18/17 09:00	Client	08/22/17 09:45
3762643	L1729058 FILTER F-7	317.0	08/18/17 09:00	Client	08/22/17 09:45

Report Summary

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call James Van Fleit at (574) 233-4777.

Jim Van Fleit ASM

09/05/2017

Authorized Signature | Title | Date

Client Name: Alpha Analytical
Report #: 396213

Client Name: Alpha Analytical Report #: 396213

Sampling Point: L1729058 RAW-7 PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	08/24/17 09:23	3762640

Sampling Point: L1729058 TROJAN-7 PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	08/24/17 09:48	3762641

Sampling Point: L1729058 FILTER E-7 PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	08/25/17 01:44	3762642

Sampling Point: L1729058 FILTER F-7 PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	08/25/17 02:09	3762643

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!

Client Name: Alpha Analytical Report #: 396213

Lab Definitions

Continuing Calibration Check Standard (CCC) / Continuing Calibration Verification (CCV) / Initial Calibration Verification Standard (ICV) / Initial Performance Check (IPC) - is a standard containing one or more of the target analytes that is prepared from the same standards used to calibrate the instrument. This standard is used to verify the calibration curve at the beginning of each analytical sequence, and may also be analyzed throughout and at the end of the sequence. The concentration of continuing standards may be varied, when prescribed by the reference method, so that the range of the calibration curve is verified on a regular basis. CCL, CCM, and CCH are the CCC standards at low, mid, and high concentration levels, respectively.

Internal Standards (IS) - are pure compounds with properties similar to the analytes of interest, which are added to field samples or extracts, calibration standards, and quality control standards at a known concentration. They are used to measure the relative responses of the analytes of interest and surrogates in the sample, calibration standard or quality control standard.

Laboratory Duplicate (LD) - is a field sample aliquot taken from the same sample container in the laboratory and analyzed separately using identical procedures. Analysis of laboratory duplicates provides a measure of the precision of the laboratory procedures.

Laboratory Fortified Blank (LFB) / Laboratory Control Sample (LCS) - is an aliquot of reagent water to which known concentrations of the analytes of interest are added. The LFB is analyzed exactly the same as the field samples. LFBs are used to determine whether the method is in control. FBL, FBM, and FBH are the LFB samples at low, mid, and high concentration levels, respectively.

Laboratory Method Blank (LMB) / Laboratory Reagent Blank (LRB) - is a sample of reagent water included in the sample batch analyzed in the same way as the associated field samples. The LMB is used to determine if method analytes or other background contamination have been introduced during the preparation or analytical procedure. The LMB is analyzed exactly the same as the field samples.

Laboratory Trip Blank (LTB) / Field Reagent Blank (FRB) - is a sample of laboratory reagent water placed in a sample container in the laboratory and treated as a field sample, including storage, preservation, and all analytical procedures. The FRB/LTB container follows the collection bottles to and from the collection site, but the FRB/LTB is not opened at any time during the trip. The FRB/LTB is primarily a travel blank used to verify that the samples were not contaminated during shipment.

Matrix Spike Duplicate Sample (MSD) / Laboratory Fortified Sample Matrix Duplicate (LFSMD) - is a sample aliquot taken from the same field sample source as the Matrix Spike Sample to which known quantities of the analytes of interest are added in the laboratory. The MSD is analyzed exactly the same as the field samples. Analysis of the MSD provides a measure of the precision of the laboratory procedures in a specific matrix. SDL, SDM, and SDH / LFSMDL, LFSMDM, and LFSMDH are the MSD or LFSMD at low, mid, and high concentration levels, respectively.

Matrix Spike Sample (MS) / Laboratory Fortified Sample Matrix (LFSM) - is a sample aliquot taken from field sample source to which known quantities of the analytes of interest are added in the laboratory. The MS is analyzed exactly the same as the field samples. The purpose is to demonstrate recovery of the analytes from a sample matrix to determine if the specific matrix contributes bias to the analytical results. MSL, MSM, and MSH / LFSML, LFSMM, and LFSMH are the MS or LFSM at low, mid, and high concentration levels, respectively.

Quality Control Standard (QCS) / Second Source Calibration Verification (SSCV) - is a solution containing known concentrations of the analytes of interest prepared from a source different from the source of the calibration standards. The solution is obtained from a second manufacturer or lot if the lot can be demonstrated by the manufacturer as prepared independently from other lots. The QCS sample is analyzed using the same procedures as field samples. The QCS is used as a check on the calibration standards used in the method on a routine basis.

Reporting Limit Check (RLC) / Initial Calibration Check Standard (ICCS) - is a procedural standard that is analyzed each day to evaluate instrument performance at or below the minimum reporting limit (MRL).

Surrogate Standard (SS) / Surrogate Analyte (SUR) - is a pure compound with properties similar to the analytes of interest, which is highly unlikely to be found in any field sample, that is added to the field samples, calibration standards, blanks and quality control standards before sample preparation. The SS is used to evaluate the efficiency of the sample preparation process.

SUB UPS: Eurofins, IN

396213 325296

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193
Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #:L1729058

Project Information

Project Name:

Project Location: MA

Project #:

Project Manager: Ethan Leighton

ALPHA Quote #:

Report Information Data Deliverables

☐ FAX ☐ EMAIL

☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program Criteria

Client Information

Client: Alpha Analytical Lab

Address: 8 Walkup Drive

Westborough, Ma 01581

Phone: 508-898-9220

Fax:

Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☐ No Are MCP Analytical Methods Required?

☐ Yes ☐ No Are CT RCP (Reasonable Confidence Protocols) Required?

Other Project Specific Requirements/Comments/Detection Limits:

Please reference Alpha Job #L1729058 on this report.

ANALYSIS

SAMPLE HANDLING

Filtration

☐ Done

☐ Not Needed

☐ Lab to do

Preservation

☐ Lab to do

(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	BROMATE	Sample Specific Comments	TOTAL # BOTTLES
3762640	RAW-7	8/18/17	09:00	DW		X		1
641	TROJAN-7	8/18/17	09:00	DW		X		1
642	FILTER E-7	8/18/17	09:00	DW		X		1
643	FILTER F-7	8/18/17	09:00	DW		X		1
							0.6°C wet	

Container Type: P - - - - - - - - - - -

Preservative: O - - - - - - - - - - -

Serial_No:09121714:48

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time
			8-22-17 0945

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

FORM NO. 01-01(I) (rev. 30-Jul-07)

ANALYTICAL REPORT

Lab Number:	L1729617
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Erik Grotton
Phone:	(508) 248-7094
Project Name:	MAHER WELL PILOT
Project Number:	20107
Report Date:	09/13/17

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1729617
Report Date: 09/13/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1729617-01	RAW-8	DW	BARNSTABLE, MA	08/23/17 09:00	08/23/17
L1729617-02	TROJAN -8	DW	BARNSTABLE, MA	08/23/17 09:00	08/23/17
L1729617-03	FILTER E-8	DW	BARNSTABLE, MA	08/23/17 09:00	08/23/17
L1729617-04	FILTER F-8	DW	BARNSTABLE, MA	08/23/17 09:00	08/23/17
L1729617-05	FIELD BLANK	DW	BARNSTABLE, MA	08/23/17 09:00	08/23/17

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729617
Report Date: 09/13/17

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. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated 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.

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 table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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 Client Service Representative 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 Client Services at 800-624-9220 with any questions.

Project Name: MAHER WELL PILOT **Lab Number:** L1729617
Project Number: 20107 **Report Date:** 09/13/17

Case Narrative (continued)

Report Submission

The analysis of Bromate was subcontracted. A copy of the laboratory report is included as an addendum.

Please note: This data is only available in PDF format and is not available on Data Merger.

Perfluorinated Alkyl Acids

The WG1036202-3 LCSD recovery, associated with L1729617-01 through -05, is outside the individual acceptance criteria for perfluorooctanesulfonic acid (pfos) (134%). The results of the associated samples are reported.

The WG1036202-5 MS recovery, performed on L1729617-02, is outside the acceptance criteria for perfluorooctanesulfonic acid (pfos) (136%).

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: Kelly Stenstrom

Title: Technical Director/Representative Date: 09/13/17

ORGANICS

SEMIVOLATILES

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729617
Report Date: 09/13/17

SAMPLE RESULTS

Lab ID: L1729617-01
Client ID: RAW-8
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 09/06/17 17:28
Analyst: TJ

Date Collected: 08/23/17 09:00
Date Received: 08/23/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 09/05/17 09:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.553		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	103		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729617
Report Date: 09/13/17

SAMPLE RESULTS

Lab ID: L1729617-01
Client ID: RAW-8
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/12/17 11:31
Analyst: AR

Date Collected: 08/23/17 09:00
Date Received: 08/23/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/28/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	17.4		ng/l	1.85	--	1
Perfluorooctanesulfonic Acid (PFOS)	77.1		ng/l	1.85	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	113		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	109		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	116		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729617
Report Date: 09/13/17

SAMPLE RESULTS

Lab ID: L1729617-02
Client ID: TROJAN -8
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 09/06/17 18:21
Analyst: TJ

Date Collected: 08/23/17 09:00
Date Received: 08/23/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 09/05/17 09:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	99		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729617
Report Date: 09/13/17

SAMPLE RESULTS

Lab ID: L1729617-02
Client ID: TROJAN -8
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/12/17 11:50
Analyst: AR

Date Collected: 08/23/17 09:00
Date Received: 08/23/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/28/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	20.7		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	85.7		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	99		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	97		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	104		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729617
Report Date: 09/13/17

SAMPLE RESULTS

Lab ID: L1729617-03
Client ID: FILTER E-8
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 09/06/17 19:17
Analyst: TJ

Date Collected: 08/23/17 09:00
Date Received: 08/23/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 09/05/17 09:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	99		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729617
Report Date: 09/13/17

SAMPLE RESULTS

Lab ID: L1729617-03
Client ID: FILTER E-8
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/12/17 12:59
Analyst: AR

Date Collected: 08/23/17 09:00
Date Received: 08/23/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/28/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	105		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	102		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	102		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729617
Report Date: 09/13/17

SAMPLE RESULTS

Lab ID: L1729617-04
Client ID: FILTER F-8
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 09/06/17 19:46
Analyst: TJ

Date Collected: 08/23/17 09:00
Date Received: 08/23/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 09/05/17 09:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.144	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	100		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729617
Report Date: 09/13/17

SAMPLE RESULTS

Lab ID: L1729617-04
Client ID: FILTER F-8
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/12/17 13:08
Analyst: AR

Date Collected: 08/23/17 09:00
Date Received: 08/23/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/28/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	111		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	112		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	101		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729617
Report Date: 09/13/17

SAMPLE RESULTS

Lab ID: L1729617-05
Client ID: FIELD BLANK
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/12/17 13:18
Analyst: AR

Date Collected: 08/23/17 09:00
Date Received: 08/23/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 08/28/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.78	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.78	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	113		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	116		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	110		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729617
Report Date: 09/13/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 122,537
Analytical Date: 09/12/17 11:22
Analyst: AR

Extraction Method: EPA 537
Extraction Date: 08/28/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab for sample(s): 01-05 Batch: WG1036202-1					
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	107		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	101		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	109		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729617
Report Date: 09/13/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 120,522
Analytical Date: 09/05/17 11:24
Analyst: TJ

Extraction Method: EPA 522
Extraction Date: 09/05/17 09:30

Parameter	Result	Qualifier	Units	RL	MDL
1,4 Dioxane by EPA 522 - Mansfield Lab for sample(s): 01-04 Batch: WG1038558-1					
1,4-Dioxane	ND		ug/l	0.150	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	102		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1729617

Report Date: 09/13/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01-05 Batch: WG1036202-2 WG1036202-3								
Perfluorooctanoic Acid (PFOA)	116		127		70-130	9		30
Perfluorooctanesulfonic Acid (PFOS)	128		**134**	Q	70-130	5		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	119		112		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	99		98		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	106		107		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1729617

Report Date: 09/13/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-04 Batch: WG1038558-2 WG1038558-3								
1,4-Dioxane	74		75		70-130	1		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,4-Dioxane-d8	81		82		70-130

Matrix Spike Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729617
Report Date: 09/13/17

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 - Mansfield Lab Associated sample(s): 01-05 QC Batch ID: WG1036202-5 QC Sample: L1729617-02 Client ID: TROJAN -8												
Perfluorooctanoic Acid (PFOA)	20.7	34.5	64.4	127		-	-		70-130	-		30
Perfluorooctanesulfonic Acid (PFOS)	85.7	31.9	129	**136**	Q	-	-		70-130	-		30

Surrogate	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	119				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	105				70-130
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	109				70-130

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1038558-5 QC Sample: L1729617-02 Client ID: TROJAN -8												
1,4-Dioxane	ND	9.8	8.49	87		-	-		70-130	-		30

Surrogate	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
1,4-Dioxane-d8	102				70-130

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1729617
Report Date: 09/13/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01-05 QC Batch ID: WG1036202-4 QC Sample: L1729617-01 Client ID: RAW-8						
Perfluorooctanoic Acid (PFOA)	17.4	18.9	ng/l	8		30
Perfluorooctanesulfonic Acid (PFOS)	77.1	75.0	ng/l	3		30

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	113		113		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	109		109		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	116		108		70-130

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1038558-4 QC Sample: L1729617-01 Client ID: RAW-8						
1,4-Dioxane	0.553	0.643	ug/l	15		30

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	103		105		70-130

METALS

Project Name: MAHER WELL PILOT
Lab Number: L1729617
Project Number: 20107
Report Date: 09/13/17

SAMPLE RESULTS

Lab ID: L1729617-01
Client ID: RAW-8
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/23/17 09:00
Date Received: 08/23/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.087		mg/l	0.050	--	1	08/24/17 15:05	08/29/17 11:25	EPA 3005A	19,200.7	AM
Manganese, Total	0.050		mg/l	0.010	--	1	08/24/17 15:05	08/29/17 11:25	EPA 3005A	19,200.7	AM

Project Name: MAHER WELL PILOT
Lab Number: L1729617
Project Number: 20107
Report Date: 09/13/17

SAMPLE RESULTS

Lab ID: L1729617-02
Client ID: TROJAN -8
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/23/17 09:00
Date Received: 08/23/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.082		mg/l	0.050	--	1	08/24/17 15:05	08/29/17 12:13	EPA 3005A	19,200.7	AM
Manganese, Total	0.053		mg/l	0.010	--	1	08/24/17 15:05	08/29/17 12:13	EPA 3005A	19,200.7	AM

Project Name: MAHER WELL PILOT
Lab Number: L1729617
Project Number: 20107
Report Date: 09/13/17

SAMPLE RESULTS

Lab ID: L1729617-03
Client ID: FILTER E-8
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/23/17 09:00
Date Received: 08/23/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	08/24/17 15:05	08/29/17 12:17	EPA 3005A	19,200.7	AM
Manganese, Total	0.052		mg/l	0.010	--	1	08/24/17 15:05	08/29/17 12:17	EPA 3005A	19,200.7	AM

Project Name: MAHER WELL PILOT
Lab Number: L1729617
Project Number: 20107
Report Date: 09/13/17

SAMPLE RESULTS

Lab ID: L1729617-04
Client ID: FILTER F-8
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/23/17 09:00
Date Received: 08/23/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	08/24/17 15:05	08/29/17 12:42	EPA 3005A	19,200.7	AM
Manganese, Total	0.051		mg/l	0.010	--	1	08/24/17 15:05	08/29/17 12:42	EPA 3005A	19,200.7	AM

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729617
Report Date: 09/13/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-04 Batch: WG1035157-1										
Iron, Total	ND		mg/l	0.050	--	1	08/24/17 15:05	08/29/17 09:39	19,200.7	AM
Manganese, Total	ND		mg/l	0.010	--	1	08/24/17 15:05	08/29/17 09:39	19,200.7	AM

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1729617

Report Date: 09/13/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 Batch: WG1035157-2								
Iron, Total	113		-		85-115	-		
Manganese, Total	103		-		85-115	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1729617
Report Date: 09/13/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1035157-3 QC Sample: L1729408-01 Client ID: MS Sample												
Iron, Total	0.063	1	1.19	113		-	-		75-125	-		20
Manganese, Total	ND	0.5	0.524	105		-	-		75-125	-		20
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1035157-7 QC Sample: L1729713-01 Client ID: MS Sample												
Iron, Total	0.182	1	1.29	111		-	-		75-125	-		20
Manganese, Total	ND	0.5	0.532	106		-	-		75-125	-		20

INORGANICS
&
MISCELLANEOUS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729617
Report Date: 09/13/17

SAMPLE RESULTS

Lab ID: L1729617-01
Client ID: RAW-8
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/23/17 09:00
Date Received: 08/23/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.39		NTU	0.20	--	1	-	08/24/17 11:40	44,180.1	LH
Alkalinity, Total	13.1		mg CaCO3/L	2.00	NA	1	-	08/24/17 10:30	121,2320B	BR
pH (H)	5.4		SU	-	NA	1	-	08/23/17 19:30	121,4500H+-B	CW

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1729617
Report Date: 09/13/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1035022-1										
Turbidity	ND		NTU	0.20	--	1	-	08/24/17 11:40	44,180.1	LH
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1035099-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	08/24/17 10:30	121,2320B	BR

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1729617

Report Date: 09/13/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1034871-1								
pH	100		-		99-101	-		5
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1035022-2								
Turbidity	108		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1035099-2								
Alkalinity, Total	104		-		90-110	-		10

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1729617
Report Date: 09/13/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1035099-4 QC Sample: L1729654-01 Client ID: MS Sample												
Alkalinity, Total	45.5	100	145	100		-	-		86-116	-		10

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1729617
Report Date: 09/13/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1034871-2 QC Sample: L1729676-01 Client ID: DUP Sample						
pH	4.8	4.9	SU	2		5
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1035022-3 QC Sample: L1729617-01 Client ID: RAW-8						
Turbidity	0.39	0.37	NTU	5		13
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1035099-3 QC Sample: L1729654-01 Client ID: DUP Sample						
Alkalinity, Total	45.5	44.8	mg CaCO3/L	2		10

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1729617
Report Date: 09/13/17

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent
B	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1729617-01A	Plastic 120ml HNO3 preserved	A	<2	<2	5.0	Y	Absent		FE-UI(180),MN-UI(180)
L1729617-01B	Plastic 120ml Other preserved (sub-lab)	A	7	7	5.0	Y	Absent		SUB-BROMATE(0)
L1729617-01C	Plastic 250ml unpreserved/No Headspace	A	NA		5.0	Y	Absent		ALK-T-2320(14),TURB-180(2),PH-4500(.01)
L1729617-01D	Plastic 250ml Trizma preserved	A	NA		5.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1729617-01E	Plastic 250ml Trizma preserved	A	NA		5.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1729617-01F	Plastic 250ml Trizma preserved	A	NA		5.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1729617-01G	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.0	Y	Absent		A2-14DIOXANE-522(28)
L1729617-01H	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.0	Y	Absent		A2-14DIOXANE-522(28)
L1729617-02A	Plastic 120ml HNO3 preserved	A	<2	<2	5.0	Y	Absent		FE-UI(180),MN-UI(180)
L1729617-02B	Plastic 120ml Other preserved (sub-lab)	A	7	7	5.0	Y	Absent		SUB-BROMATE(0)
L1729617-02D	Plastic 250ml Trizma preserved	A	NA		5.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1729617-02E	Plastic 250ml Trizma preserved	A	NA		5.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1729617-02F	Plastic 250ml Trizma preserved	A	NA		5.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1729617-02G	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.0	Y	Absent		A2-14DIOXANE-522(28)
L1729617-02H	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.0	Y	Absent		A2-14DIOXANE-522(28)
L1729617-03A	Plastic 120ml HNO3 preserved	A	<2	<2	5.0	Y	Absent		FE-UI(180),MN-UI(180)
L1729617-03B	Plastic 120ml Other preserved (sub-lab)	A	7	7	5.0	Y	Absent		SUB-BROMATE(0)
L1729617-03D	Plastic 250ml Trizma preserved	A	NA		5.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1729617-03E	Plastic 250ml Trizma preserved	A	NA		5.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1729617-03F	Plastic 250ml Trizma preserved	A	NA		5.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1729617-03G	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.0	Y	Absent		A2-14DIOXANE-522(28)
L1729617-03H	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.0	Y	Absent		A2-14DIOXANE-522(28)

*Values in parentheses indicate holding time in days

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1729617
Report Date: 09/13/17

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1729617-04A	Plastic 120ml HNO3 preserved	A	<2	<2	5.0	Y	Absent		FE-UI(180),MN-UI(180)
L1729617-04B	Plastic 120ml Other preserved (sub-lab)	A	7	7	5.0	Y	Absent		SUB-BROMATE(0)
L1729617-04D	Plastic 250ml Trizma preserved	A	NA		5.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1729617-04E	Plastic 250ml Trizma preserved	A	NA		5.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1729617-04F	Plastic 250ml Trizma preserved	A	NA		5.0	Y	Absent		A2-537-PFOA/PFOS(14)
L1729617-04G	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.0	Y	Absent		A2-14DIOXANE-522(28)
L1729617-04H	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	5.0	Y	Absent		A2-14DIOXANE-522(28)
L1729617-05A	Plastic 250ml Trizma preserved	B	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)

*Values in parentheses indicate holding time in days

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1729617
Project Number:	20107	**Report Date:**	09/13/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1729617
Project Number:	20107	**Report Date:**	09/13/17

Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1729617
Project Number:	20107	**Report Date:**	09/13/17

REFERENCES

19 Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

120 Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography/Mass Spectrometry (GC/MS) with Selected Ion Monitoring (SIM). EPA Method 522, EPA/600/R-08/101. Version 1.0, September 2008.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

122 Determination of Selected Perfluorintated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). EPA Method 537, EPA/600/R-08/092. Version 1.1, September 2009.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

8 Walkup Drive, Westboro, MA 01581, Tel: 508-898-9220

320 Forbes Blvd, Mansfield, MA 02048, Tel: 508-822-9300

Date Rec'd in Lab: 08/23/17

ALPHA Job #: L1729617

Project Information

Project Name: Maher Well Pilot

Project Location: Barnstable, MA

Project #: 20107

Project Manager: Erik Grotton

ALPHA Quote #:

Report Information - Data Deliverables

☐ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info PO #:

Client Information

Client: Blueleaf, Inc.

Address: 57 Dresser Hill Rd, Charlton, MA 01507

Phone: 774 200 8029

Email: egrotton@blueleafwater.com

Additional Project Information:

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods

☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)

☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)

☐ Yes ☐ No NPDES RGP

☐ Other State /Fed Program ________ Criteria ________

Turn-Around Time

☐ Standard ☐ RUSH *(only confirmed if pre-approved!)*

Date Due:

ANALYSIS

VOC: ☐ 8260 ☐ 624 ☐ 524.2; SVOC: ☐ ABN ☐ PAH; METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15; METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13; EPH: ☐ Ranges & Targets ☐ Ranges Only; VPH: ☐ Ranges & Targets ☐ Ranges Only; ☐ PCB ☐ PEST; TPH: ☐ Quant Only ☐ Fingerprint

SAMPLE INFO — Filtration: ☐ Field ☐ Lab to do; Preservation: ☐ Lab to do

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	Total Fe + Mn	Alk + pH + Turbidity	Bromate	1,4 Dioxane	PFOS, PFOA	Sample Comments	TOTAL # BOTTLES
29617-01	RAW-8	8/23/17	9:00	DW	ARD	X	X	X	X	X		8
02	Trojan-8	↓	↓	↓	↓	X		X	X	X		7
03	Filter E-8	↓	↓	↓	↓	X		X	X	X		7
04	Filter F-8	↓	↓	↓	↓	X		X	X	X		7
05	Field Blank	↓	↓	↓	↓					X		1

Container Type

Preservative

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	8/23/17 13:13	[signature] AAL	8/23/17 13:13

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

SUB UPS: **Eurofins, IN** (DM)

CHAIN OF CUSTODY

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193
Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #:L172 9617

Project Information

Project Name:

Project Location: MA

Project #:

Project Manager: Ethan Leighton

ALPHA Quote #:

Report Information Data Deliverables

☐ FAX ☐ EMAIL

☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program *Criteria*

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☒ No Are MCP Analytical Methods Required?

☐ Yes ☒ No Are CT RCP (Reasonable Confidence Protocols) Required?

Client Information

Client: Alpha Analytical Lab

Address: 8 Walkup Drive

Westborough, Ma 01581

Phone: 508-898-9220

Fax:

Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

Other Project Specific Requirements/Comments/Detection Limits:

Please reference Alpha Job # **L172 9617** on this report.

ANALYSIS

SAMPLE HANDLING
Filtration
☐ Done
☐ Not Needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	BROMATE	Sample Specific Comments	TOTAL # BOTTLES
	RAW-8	8/23/17	09:00	DW		X		1
	TROJAN -8	8/23/17	09:00	DW		X		1
	FILTER E-8	8/23/17	09:00	DW		X		1
	FILTER F-8	8/23/17	09:00	DW		X		1

Container Type	P		-	-	-	-	-	-	-	-	-	-	
Preservative	TRIZMA		-	-	-	-	-	-	-	-	-	-	

PLEASE ANSWER QUESTIONS ABOVE!

S YOUR PROJECT
MA MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

SUB UPS: **Eurofins, IN** (DM)

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193

Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Project Information

Project Name:

Project Location: MA

Project #:

Project Manager: Ethan Leighton

ALPHA Quote #:

Client Information

Client: Alpha Analytical Lab

Address: 8 Walkup Drive

Westborough, Ma 01581

Phone: 508-898-9220

Fax:

Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

Other Project Specific Requirements/Comments/Detection Limits:

Please reference Alpha Job # **L172 9617** on this report.

Date Rec'd in Lab:

ALPHA Job #:L172 9617

Report Information Data Deliverables

☐ FAX ☐ EMAIL

☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program *Criteria*

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☒ No Are MCP Analytical Methods Required?

☐ Yes ☒ No Are CT RCP (Reasonable Confidence Protocols) Required?

ANALYSIS

SAMPLE HANDLING

Filtration

☐ Done

☐ Not Needed

☐ Lab to do

Preservation

☐ Lab to do

(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	BROMATE	Sample Specific Comments	TOTAL # BOTTLES
	RAW-8	8/23/17	09:00	DW		X		1
	TROJAN -8	8/23/17	09:00	DW		X		1
	FILTER E-8	8/23/17	09:00	DW		X		1
	FILTER F-8	8/23/17	09:00	DW		X		1

Container Type	P		-	-	-	-	-	-	-	-	-	-	
Preservative	TRIZMA		-	-	-	-	-	-	-	-	-	-	

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time
	8/24/17 09:30		

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

FORM NO: 01-01(I) (rev. 30-JUL-07)

Shipment Receipt

Transaction Date: 24 Aug 2017 **Tracking Number:** 1ZE306540198407005

1 ADDRESS INFORMATION

Ship To:
Eurofins Eaton Analytical
110 South Hill Street
SOUTH BEND IN 466172702
Telephone:574-233-4777

Ship From:
Walkup
Login Dept Westboro
8 Walkup Dr
Westborough MA 01581
Telephone:508-898-9220
email:login@alphalab.com

Return Address:
Walkup
Login Dept Westboro
8 Walkup Dr
Westborough MA 01581
Telephone:508-898-9220 email:login@alphalab.com

2 PACKAGE INFORMATION

	WEIGHT	DIMENSIONS / PACKAGING	DECLARED VALUE	REFERENCE NUMBERS
1.	11.0 lbs (15.0 lbs billable)	14 x 14 x 10in. Other Packaging	100.00 USD	

3 UPS SHIPPING SERVICE AND SHIPPING OPTIONS

Service: UPS Next Day Air
Guaranteed By: 10:30 AM Friday, Aug 25, 2017
Shipping Fees Subtotal: 145.17 USD

Transportation	137.93 USD
Fuel Surcharge	7.24 USD
Declared Value	
Package 1	0.00 USD

4 PAYMENT INFORMATION

Bill Shipping Charges to: Shipper's Account E30654

Shipping Charges:	145.17 USD
A discount has been applied to the Daily rates for this shipment	
Negotiated Charges:	53.46 USD
Subtotal Shipping Charges:	53.46 USD
Total Charges:	53.46 USD

Note: This document is not an invoice. Your final invoice may vary from the displayed reference rates.

* For delivery and guarantee information, see the UPS Service Guide ({0}). To speak to a customer service representative, call 1-800-PICK-UPS for domestic services and 1-800-782-7892 for international services.

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LABORATORY REPORT

If you have any questions concerning this report, please do not hesitate to call us at (800) 332-4345 or (574) 233-4777.

eurofins | Eaton Analytical

STATE CERTIFICATION LIST

State	Certification	State	Certification
Alabama	40700	Missouri	880
Alaska	IN00035	Montana	CERT0026
Arizona	AZ0432	Nebraska	NE-OS-05-04
Arkansas	IN00035	Nevada	IN00035
California	2920	New Hampshire*	2124
Colorado	IN035	New Jersey*	IN598
Colorado Radiochemistry	IN035	New Mexico	IN00035
Connecticut	PH-0132	New York*	11398
Delaware	IN035	North Carolina	18700
Florida*	E87775	North Dakota	R-035
Georgia	929	Ohio	87775
Hawaii	IN035	Oklahoma	D9508
Idaho	IN00035	Oregon (Primary AB)*	4074-001
Illinois*	200001	Pennsylvania*	68-00466
Illinois Microbiology	17767	Puerto Rico	IN00035
Illinois Radiochemistry	IN00035	Rhode Island	LAO00343
Indiana Chemistry	C-71-01	South Carolina	95005
Indiana Microbiology	M-76-07	South Dakota	IN00035
Iowa	098	Tennessee	TN02973
Kansas*	E-10233	Texas*	T104704187-15-8
Kentucky	90056	Texas/TCEQ	TX207
Louisiana*	LA170006	Utah*	IN00035
Maine	IN00035	Vermont	VT-8775
Maryland	209	Virginia*	460275
Massachusetts	M-IN035	Washington	C837
Michigan	9926	West Virginia	9927 C
Minnesota*	018-999-338	Wisconsin	999766900
Mississippi	IN035	Wyoming	IN035
EPA	IN00035		

*NELAP/TNI Recognized Accreditation Bodies

Revision date: 08/28/2017

eurofins | Eaton Analytical

110 South Hill Street
South Bend, IN 46617
Tel: (574) 233-4777
Fax: (574) 233-8207
1 800 332 4345

Laboratory Report

Client: Alpha Analytical

Attn: Ethan Leighton
35 Whitney Road
Suite 5
Mahwah, NJ 07430

Report: 396593
Priority: Standard Written
Status: Final
PWS ID: Not Supplied

Sample Information

EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3766097	Raw-8/L1729617-1	317.0	08/23/17 09:00	Client	08/25/17 10:00
3766098	Trojan-8/L1729617-2	317.0	08/23/17 09:00	Client	08/25/17 10:00
3766099	Filter E-8/L1729617-3	317.0	08/23/17 09:00	Client	08/25/17 10:00
3766100	Filter F-8/L1729617-4	317.0	08/23/17 09:00	Client	08/25/17 10:00

Report Summary

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call James Van Fleit at (574) 233-4777.

Jim Van Fleit ASM

09/07/2017

Authorized Signature | Title | Date

Client Name: Alpha Analytical
Report #: 396593

Client Name: Alpha Analytical Report #: 396593

Sampling Point: Raw-8/L1729617-1 PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	09/05/17 20:25	3766097

Sampling Point: Trojan-8/L1729617-2 PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	09/05/17 20:50	3766098

Sampling Point: Filter E-8/L1729617-3 PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	09/05/17 21:15	3766099

Sampling Point: Filter F-8/L1729617-4 PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	09/05/17 21:40	3766100

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!

Client Name: Alpha Analytical Report #: 396593

Lab Definitions

Continuing Calibration Check Standard (CCC) / Continuing Calibration Verification (CCV) / Initial Calibration Verification Standard (ICV) / Initial Performance Check (IPC) - is a standard containing one or more of the target analytes that is prepared from the same standards used to calibrate the instrument. This standard is used to verify the calibration curve at the beginning of each analytical sequence, and may also be analyzed throughout and at the end of the sequence. The concentration of continuing standards may be varied, when prescribed by the reference method, so that the range of the calibration curve is verified on a regular basis. CCL, CCM, and CCH are the CCC standards at low, mid, and high concentration levels, respectively.

Internal Standards (IS) - are pure compounds with properties similar to the analytes of interest, which are added to field samples or extracts, calibration standards, and quality control standards at a known concentration. They are used to measure the relative responses of the analytes of interest and surrogates in the sample, calibration standard or quality control standard.

Laboratory Duplicate (LD) - is a field sample aliquot taken from the same sample container in the laboratory and analyzed separately using identical procedures. Analysis of laboratory duplicates provides a measure of the precision of the laboratory procedures.

Laboratory Fortified Blank (LFB) / Laboratory Control Sample (LCS) - is an aliquot of reagent water to which known concentrations of the analytes of interest are added. The LFB is analyzed exactly the same as the field samples. LFBs are used to determine whether the method is in control. FBL, FBM, and FBH are the LFB samples at low, mid, and high concentration levels, respectively.

Laboratory Method Blank (LMB) / Laboratory Reagent Blank (LRB) - is a sample of reagent water included in the sample batch analyzed in the same way as the associated field samples. The LMB is used to determine if method analytes or other background contamination have been introduced during the preparation or analytical procedure. The LMB is analyzed exactly the same as the field samples.

Laboratory Trip Blank (LTB) / Field Reagent Blank (FRB) - is a sample of laboratory reagent water placed in a sample container in the laboratory and treated as a field sample, including storage, preservation, and all analytical procedures. The FRB/LTB container follows the collection bottles to and from the collection site, but the FRB/LTB is not opened at any time during the trip. The FRB/LTB is primarily a travel blank used to verify that the samples were not contaminated during shipment.

Matrix Spike Duplicate Sample (MSD) / Laboratory Fortified Sample Matrix Duplicate (LFSMD) - is a sample aliquot taken from the same field sample source as the Matrix Spike Sample to which known quantities of the analytes of interest are added in the laboratory. The MSD is analyzed exactly the same as the field samples. Analysis of the MSD provides a measure of the precision of the laboratory procedures in a specific matrix. SDL, SDM, and SDH / LFSMDL, LFSMDM, and LFSMDH are the MSD or LFSMD at low, mid, and high concentration levels, respectively.

Matrix Spike Sample (MS) / Laboratory Fortified Sample Matrix (LFSM) - is a sample aliquot taken from field sample source to which known quantities of the analytes of interest are added in the laboratory. The MS is analyzed exactly the same as the field samples. The purpose is to demonstrate recovery of the analytes from a sample matrix to determine if the specific matrix contributes bias to the analytical results. MSL, MSM, and MSH / LFSML, LFSMM, and LFSMH are the MS or LFSM at low, mid, and high concentration levels, respectively.

Quality Control Standard (QCS) / Second Source Calibration Verification (SSCV) - is a solution containing known concentrations of the analytes of interest prepared from a source different from the source of the calibration standards. The solution is obtained from a second manufacturer or lot if the lot can be demonstrated by the manufacturer as prepared independently from other lots. The QCS sample is analyzed using the same procedures as field samples. The QCS is used as a check on the calibration standards used in the method on a routine basis.

Reporting Limit Check (RLC) / Initial Calibration Check Standard (ICCS) - is a procedural standard that is analyzed each day to evaluate instrument performance at or below the minimum reporting limit (MRL).

Surrogate Standard (SS) / Surrogate Analyte (SUR) - is a pure compound with properties similar to the analytes of interest, which is highly unlikely to be found in any field sample, that is added to the field samples, calibration standards, blanks and quality control standards before sample preparation. The SS is used to evaluate the efficiency of the sample preparation process.

SUB UPS: Eurofins, IN (DM)

325522

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CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193
Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #:L172 9617 396593

Project Information

Project Name:

Project Location: MA

Project #:

Project Manager: Ethan Leighton

ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

Report Information Data Deliverables

☐ FAX ☐ EMAIL

☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program Criteria

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☒ No Are MCP Analytical Methods Required?

☐ Yes ☒ No Are CT RCP (Reasonable Confidence Protocols) Required?

Client Information

Client: Alpha Analytical Lab

Address: 8 Walkup Drive

Westborough, Ma 01581

Phone: 508-898-9220

Fax:

Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Other Project Specific Requirements/Comments/Detection Limits:

Please reference Alpha Job # **L172 9617** on this report.

ANALYSIS

BROMATE | wet 1.8

SAMPLE HANDLING
Filtration
☐ Done
☐ Not Needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

TOTAL # BOTTLES

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	BROMATE	Sample Specific Comments	TOTAL # BOTTLES
	RAW-8 -1	8/23/17	09:00	DW		X	3766097	1
	TROJAN -8 -2	8/23/17	09:00	DW		X	098	1
	FILTER E-8 -3	8/23/17	09:00	DW		X	099	1
	FILTER F-8 -4	8/23/17	09:00	DW		X	100	1

Container Type	P		-	-	-	-	-	-	-	-	-	-
Preservative	TRIZMA		-	-	-	-	-	-	-	-	-	-

Serial_No:09131714:42

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT A MCP or CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time
GW	8/24/17 09:30	KDW	8-25-17 1000

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

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FORM NO: 01-01 (rev. 30-JUL-07)

ANALYTICAL REPORT

Lab Number:	L1730552
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Erik Grotton
Phone:	(508) 248-7094
Project Name:	MAHER WELLS
Project Number:	20107
Report Date:	09/18/17

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1730552
Report Date: 09/18/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1730552-01	RAW-9	DW	BARNSTABLE, MA	08/30/17 09:00	08/30/17
L1730552-02	TROJAN-9	DW	BARNSTABLE, MA	08/30/17 09:00	08/30/17
L1730552-03	FILTER E-9	DW	BARNSTABLE, MA	08/30/17 09:00	08/30/17
L1730552-04	FILTER F-9	DW	BARNSTABLE, MA	08/30/17 09:00	08/30/17
L1730552-05	FIELD BLANK	DW	BARNSTABLE, MA	08/30/17 09:00	08/30/17

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1730552
Report Date: 09/18/17

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. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated 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.

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 table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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 Client Service Representative 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 Client Services at 800-624-9220 with any questions.

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

Case Narrative (continued)

Report Submission

The analysis of Bromate was subcontracted. A copy of the laboratory report is included as an addendum.
Please note: This data is only available in PDF format and is not available on Data Merger.

Sample Receipt

Some samples were received at the laboratory above the required temperature range. The samples were transported to the laboratory in coolers with ice and delivered directly from the sampling site.

Perfluorinated Alkyl Acids

The WG1037665-2/-3 LCS/LCSD recoveries, associated with L1730552-01 through -05, are outside the individual acceptance criteria for perfluorooctanoic acid (pfoa) (146%/136%) and perfluorooctanesulfonic acid (pfos) (143%/135%). The results of the associated samples are reported.
The WG1037665-5 MS recoveries, performed on L1730552-02, are outside the acceptance criteria for perfluorooctanoic acid (pfoa) (133%) and perfluorooctanesulfonic acid (pfos) (135%).

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:  Kelly Stenstrom

Title: Technical Director/Representative Date: 09/18/17

ORGANICS

SEMIVOLATILES

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

SAMPLE RESULTS

Lab ID: L1730552-01
Client ID: RAW-9
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 09/12/17 19:20
Analyst: TJ

Date Collected: 08/30/17 09:00
Date Received: 08/30/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 09/12/17 11:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.461		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	91		70-130

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

SAMPLE RESULTS

Lab ID: L1730552-01
Client ID: RAW-9
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/06/17 19:45
Analyst: AR

Date Collected: 08/30/17 09:00
Date Received: 08/30/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 09/01/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	20.7		ng/l	1.78	--	1
Perfluorooctanesulfonic Acid (PFOS)	72.5		ng/l	1.78	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	116		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	84		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	85		70-130

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

SAMPLE RESULTS

Lab ID: L1730552-02
Client ID: TROJAN-9
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 09/12/17 19:44
Analyst: TJ

Date Collected: 08/30/17 09:00
Date Received: 08/30/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 09/12/17 11:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	93		70-130

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

SAMPLE RESULTS

Lab ID: L1730552-02
Client ID: TROJAN-9
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/06/17 20:03
Analyst: AR

Date Collected: 08/30/17 09:00
Date Received: 08/30/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 09/01/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	20.4		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	73.0		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	120		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	90		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	94		70-130

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

SAMPLE RESULTS

Lab ID: L1730552-03
Client ID: FILTER E-9
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 09/12/17 20:07
Analyst: TJ

Date Collected: 08/30/17 09:00
Date Received: 08/30/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 09/12/17 11:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	97		70-130

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

SAMPLE RESULTS

Lab ID: L1730552-03
Client ID: FILTER E-9
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/06/17 20:22
Analyst: AR

Date Collected: 08/30/17 09:00
Date Received: 08/30/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 09/01/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	121		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	87		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	86		70-130

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

SAMPLE RESULTS

Lab ID: L1730552-04
Client ID: FILTER F-9
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 09/12/17 20:30
Analyst: TJ

Date Collected: 08/30/17 09:00
Date Received: 08/30/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 09/12/17 11:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	76		70-130

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

SAMPLE RESULTS

Lab ID: L1730552-04
Client ID: FILTER F-9
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/06/17 20:31
Analyst: AR

Date Collected: 08/30/17 09:00
Date Received: 08/30/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 09/01/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.78	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.78	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	114		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	86		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	100		70-130

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

SAMPLE RESULTS

Lab ID: L1730552-05
Client ID: FIELD BLANK
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/06/17 20:40
Analyst: AR

Date Collected: 08/30/17 09:00
Date Received: 08/30/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 09/01/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	119		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	81		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	86		70-130

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 122,537
Analytical Date: 09/06/17 19:17
Analyst: AR

Extraction Method: EPA 537
Extraction Date: 09/01/17 08:00

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab for sample(s): 01-05 Batch: WG1037665-1					
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	129		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	87		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	97		70-130

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 120,522
Analytical Date: 09/12/17 12:49
Analyst: TJ

Extraction Method: EPA 522
Extraction Date: 09/12/17 11:00

Parameter	Result	Qualifier	Units	RL	MDL
1,4 Dioxane by EPA 522 - Mansfield Lab for sample(s): 01-04 Batch: WG1040812-1					
1,4-Dioxane	ND		ug/l	0.150	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	85		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELLS

Project Number: 20107

Lab Number: L1730552

Report Date: 09/18/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01-05 Batch: WG1037665-2 WG1037665-3								
Perfluorooctanoic Acid (PFOA)	**146**	Q	**136**	Q	70-130	7		30
Perfluorooctanesulfonic Acid (PFOS)	**143**	Q	**135**	Q	70-130	6		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	120		115		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	95		85		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	97		100		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELLS

Project Number: 20107

Lab Number: L1730552

Report Date: 09/18/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-04 Batch: WG1040812-2 WG1040812-3								
1,4-Dioxane	80		79		70-130	1		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,4-Dioxane-d8	77		77		70-130

Matrix Spike Analysis

Batch Quality Control

Project Name: MAHER WELLS

Project Number: 20107

Lab Number: L1730552

Report Date: 09/18/17

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 - Mansfield Lab	Associated sample(s): 01-05		QC Batch ID: WG1037665-5			QC Sample: L1730552-02			Client ID: TROJAN-9			
Perfluorooctanoic Acid (PFOA)	20.4	34.5	66.4	**133**	Q	-	-		70-130	-		30
Perfluorooctanesulfonic Acid (PFOS)	73.0	31.9	116	**135**	Q	-	-		70-130	-		30

Surrogate	*MS % Recovery*	*MS Qualifier*	*MSD % Recovery*	*MSD Qualifier*	*Acceptance Criteria*
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	90				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	88				70-130
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	115				70-130

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1730552
Report Date: 09/18/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01-05 QC Batch ID: WG1037665-4 QC Sample: L1730552-01 Client ID: RAW-9						
Perfluorooctanoic Acid (PFOA)	20.7	20.3	ng/l	2		30
Perfluorooctanesulfonic Acid (PFOS)	72.5	69.7	ng/l	4		30

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	116		112		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	84		80		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	85		84		70-130

METALS

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

SAMPLE RESULTS

Lab ID: L1730552-01
Client ID: RAW-9
Sample Location: BARNSTABLE, MA
Matrix: Dw
Date Collected: 08/30/17 09:00
Date Received: 08/30/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.089		mg/l	0.050	--	1	08/31/17 14:20	09/06/17 18:10	EPA 3005A	19,200.7	AB
Manganese, Total	0.053		mg/l	0.010	--	1	08/31/17 14:20	09/06/17 18:10	EPA 3005A	19,200.7	AB

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

SAMPLE RESULTS

Lab ID: L1730552-02
Client ID: TROJAN-9
Sample Location: BARNSTABLE, MA
Matrix: Dw
Date Collected: 08/30/17 09:00
Date Received: 08/30/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.086		mg/l	0.050	--	1	08/31/17 14:20	09/06/17 18:15	EPA 3005A	19,200.7	AB
Manganese, Total	0.051		mg/l	0.010	--	1	08/31/17 14:20	09/06/17 18:15	EPA 3005A	19,200.7	AB

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

SAMPLE RESULTS

Lab ID: L1730552-03
Client ID: FILTER E-9
Sample Location: BARNSTABLE, MA
Matrix: Dw
Date Collected: 08/30/17 09:00
Date Received: 08/30/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.148		mg/l	0.050	--	1	08/31/17 14:20	09/06/17 18:19	EPA 3005A	19,200.7	AB
Manganese, Total	0.087		mg/l	0.010	--	1	08/31/17 14:20	09/06/17 18:19	EPA 3005A	19,200.7	AB

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

SAMPLE RESULTS

Lab ID: L1730552-04
Client ID: FILTER F-9
Sample Location: BARNSTABLE, MA
Matrix: Dw
Date Collected: 08/30/17 09:00
Date Received: 08/30/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	08/31/17 14:20	09/06/17 18:24	EPA 3005A	19,200.7	AB
Manganese, Total	0.050		mg/l	0.010	--	1	08/31/17 14:20	09/06/17 18:24	EPA 3005A	19,200.7	AB

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-04 Batch: WG1037419-1										
Iron, Total	ND		mg/l	0.050	--	1	08/31/17 14:20	09/06/17 16:56	19,200.7	AB
Manganese, Total	ND		mg/l	0.010	--	1	08/31/17 14:20	09/06/17 16:56	19,200.7	AB

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELLS

Project Number: 20107

Lab Number: L1730552

Report Date: 09/18/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 Batch: WG1037419-2								
Iron, Total	104		-		85-115	-		
Manganese, Total	98		-		85-115	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1730552
Report Date: 09/18/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1037419-3 QC Sample: L1730578-01 Client ID: MS Sample												
Iron, Total	0.053	1	1.11	106		-	-		75-125	-		20
Manganese, Total	0.010	0.5	0.508	100		-	-		75-125	-		20
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1037419-7 QC Sample: L1730611-01 Client ID: MS Sample												
Iron, Total	0.082	1	1.16	108		-	-		75-125	-		20
Manganese, Total	ND	0.5	0.518	104		-	-		75-125	-		20

INORGANICS
&
MISCELLANEOUS

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

SAMPLE RESULTS

Lab ID: L1730552-01
Client ID: RAW-9
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 08/30/17 09:00
Date Received: 08/30/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.30		NTU	0.20	--	1	-	08/31/17 04:15	44,180.1	VB
Alkalinity, Total	13.8		mg CaCO3/L	2.00	NA	1	-	09/01/17 19:30	121,2320B	MR
pH (H)	6.1		SU	-	NA	1	-	08/31/17 06:23	121,4500H+-B	VB

Project Name: MAHER WELLS
Project Number: 20107
Lab Number: L1730552
Report Date: 09/18/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1037180-1										
Turbidity	ND		NTU	0.20	--	1	-	08/31/17 04:15	44,180.1	VB
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1037999-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	09/01/17 19:30	121,2320B	MR

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELLS

Project Number: 20107

Lab Number: L1730552

Report Date: 09/18/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1037180-2								
Turbidity	94		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1037205-1								
pH	100		-		99-101	-		5
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1037999-2								
Alkalinity, Total	106		-		90-110	-		10

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1730552
Report Date: 09/18/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1037999-4 QC Sample: L1730202-01 Client ID: MS Sample												
Alkalinity, Total	419	100	519	100		-	-		86-116	-		10

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1730552
Report Date: 09/18/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1037180-3 QC Sample: L1730515-01 Client ID: DUP Sample						
Turbidity	0.24	0.22	NTU	9		13
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1037205-2 QC Sample: L1730526-01 Client ID: DUP Sample						
pH	6.7	6.7	SU	0		5
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1037999-3 QC Sample: L1730202-01 Client ID: DUP Sample						
Alkalinity, Total	419	423	mg CaCO3/L	1		10

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1730552
Report Date: 09/18/17

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent
B	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1730552-01A	Plastic 120ml HNO3 preserved	B	<2	<2	7.4	Y	Absent		FE-UI(180),MN-UI(180)
L1730552-01B	Plastic 120ml Other preserved (sub-lab)	B	7	7	7.4	Y	Absent		SUB-BROMATE(0)
L1730552-01C	Plastic 250ml unpreserved/No Headspace	B	NA		7.4	Y	Absent		ALK-T-2320(14),TURB-180(2),PH-4500(.01)
L1730552-01D	Plastic 250ml Trizma preserved	B	NA		7.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1730552-01E	Plastic 250ml Trizma preserved	B	NA		7.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1730552-01F	Plastic 250ml Trizma preserved	B	NA		7.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1730552-01G	Amber 500ml NaSulfite/NaHSO4 preserved	B	4	4	7.4	Y	Absent		A2-14DIOXANE-522(28)
L1730552-01H	Amber 500ml NaSulfite/NaHSO4 preserved	B	4	4	7.4	Y	Absent		A2-14DIOXANE-522(28)
L1730552-02A	Plastic 120ml HNO3 preserved	B	<2	<2	7.4	Y	Absent		FE-UI(180),MN-UI(180)
L1730552-02B	Plastic 120ml Other preserved (sub-lab)	B	7	7	7.4	Y	Absent		SUB-BROMATE(0)
L1730552-02D	Plastic 250ml Trizma preserved	B	NA		7.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1730552-02E	Plastic 250ml Trizma preserved	B	NA		7.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1730552-02F	Plastic 250ml Trizma preserved	B	NA		7.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1730552-02G	Amber 500ml NaSulfite/NaHSO4 preserved	B	4	4	7.4	Y	Absent		A2-14DIOXANE-522(28)
L1730552-02H	Amber 500ml NaSulfite/NaHSO4 preserved	B	4	4	7.4	Y	Absent		A2-14DIOXANE-522(28)
L1730552-03A	Plastic 120ml HNO3 preserved	B	<2	<2	7.4	Y	Absent		FE-UI(180),MN-UI(180)
L1730552-03B	Plastic 120ml Other preserved (sub-lab)	B	7	7	7.4	Y	Absent		SUB-BROMATE(0)
L1730552-03D	Plastic 250ml Trizma preserved	B	NA		7.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1730552-03E	Plastic 250ml Trizma preserved	B	NA		7.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1730552-03F	Plastic 250ml Trizma preserved	B	NA		7.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1730552-03G	Amber 500ml NaSulfite/NaHSO4 preserved	B	4	4	7.4	Y	Absent		A2-14DIOXANE-522(28)
L1730552-03H	Amber 500ml NaSulfite/NaHSO4 preserved	B	4	4	7.4	Y	Absent		A2-14DIOXANE-522(28)

*Values in parentheses indicate holding time in days

Project Name: MAHER WELLS
Project Number: 20107

Lab Number: L1730552
Report Date: 09/18/17

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1730552-04A	Plastic 120ml HNO3 preserved	B	<2	<2	7.4	Y	Absent		FE-UI(180),MN-UI(180)
L1730552-04B	Plastic 120ml Other preserved (sub-lab)	B	7	7	7.4	Y	Absent		SUB-BROMATE(0)
L1730552-04D	Plastic 250ml Trizma preserved	B	NA		7.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1730552-04E	Plastic 250ml Trizma preserved	B	NA		7.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1730552-04F	Plastic 250ml Trizma preserved	B	NA		7.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1730552-04G	Amber 500ml NaSulfite/NaHSO4 preserved	B	3	3	7.4	Y	Absent		A2-14DIOXANE-522(28)
L1730552-04H	Amber 500ml NaSulfite/NaHSO4 preserved	B	3	3	7.4	Y	Absent		A2-14DIOXANE-522(28)
L1730552-05A	Plastic 250ml Trizma preserved	A	NA		4.2	Y	Absent		A2-537-PFOA/PFOS(14)

*Values in parentheses indicate holding time in days

Project Name:	MAHER WELLS	**Lab Number:**	L1730552
Project Number:	20107	**Report Date:**	09/18/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	MAHER WELLS	**Lab Number:**	L1730552
Project Number:	20107	**Report Date:**	09/18/17

Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name:	MAHER WELLS	**Lab Number:**	L1730552
Project Number:	20107	**Report Date:**	09/18/17

REFERENCES

19 Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

120 Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography/Mass Spectrometry (GC/MS) with Selected Ion Monitoring (SIM). EPA Method 522, EPA/600/R-08/101. Version 1.0, September 2008.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

122 Determination of Selected Perfluorintated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). EPA Method 537, EPA/600/R-08/092. Version 1.1, September 2009.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 8/30/17

ALPHA Job #: L1730552

ALPHA ANALYTICAL

8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

Project Information

Project Name: Maher Wells

Project Location: Barnstable, MA

Project #: 20107

Project Manager: Erik Gratton

ALPHA Quote #:

Report Information - Data Deliverables

☐ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info PO #:

Client Information

Client: Blueleaf, Inc.

Address: 57 Dresser Hill Rd
Charlton, MA 01507

Phone: 774 230 8029

Email: egratton@blueleafwater.com

Turn-Around Time

☒ Standard ☐ RUSH *(only confirmed if pre-approved!)*

Date Due:

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

Additional Project Information:

ANALYSIS

VOC: ☐ 8260 ☐ 624 ☐ 524.2
SVOC: ☐ ABN ☐ PAH
METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15
METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13
EPH: ☐ Ranges & Targets ☐ Ranges Only
VPH: ☐ Ranges & Targets ☐ Ranges Only
☐ PCB ☐ PEST
TPH: ☐ Quant Only ☐ Fingerprint
Total Fe + Mn
Alk, pH, Turb
14 Dioxane
PFOS / PFOA
Bromide

SAMPLE INFO
Filtration
☐ Field
☐ Lab to do
Preservation
☐ Lab to do

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	Sample Comments	TOTAL # BOTTLES
30552-01	Raw-9	8/30	9:00	DW	ARD		8
02	Trojan-9	↓	↓	↓	↓		7
03	Filter E-9						7
04	Filter F-9						7
05	Field Blank						1

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Container Type	
Preservative	

Relinquished By:	Date/Time	Received By:	Date/Time
8/30/17	16:25	ARD	8/30/17 1625

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO. 01-01 (rev. 12-Mar-2012)

SUB UPS: Eurofins, IN

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193
Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #: L1730552

Project Information

Project Name:

Project Location: MA

Project #:

Project Manager: Ethan Leighton

ALPHA Quote #:

Report Information Data Deliverables

☐ FAX ☐ EMAIL

☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program | Criteria

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☐ No Are MCP Analytical Methods Required?

☐ Yes ☐ No Are CT RCP (Reasonable Confidence Protocols) Required?

Client Information

Client: Alpha Analytical Lab

Address: 8 Walkup Drive

Westborough, Ma 01581

Phone: 508-898-9220

Fax:

Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

Other Project Specific Requirements/Comments/Detection Limits:

Please reference Alpha Job #L1730552 on this report.

ANALYSIS

SAMPLE HANDLING

Filtration

☐ Done

☐ Not Needed

☐ Lab to do

Preservation

☐ Lab to do

(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Bromate	Sample Specific Comments	TOTAL # BOTTLES
	RAW-9	8/30/17	09:00	W		X		1
	TROJAN-9	8/30/17	09:00	W		X		1
	FILTER E-9	8/30/17	09:00	W		X		1
	FILTER F-9	8/30/17	09:00	W		X		1

Container Type	P		-	-	-	-	-	-	-	-	-	-	
Preservative	A		-	-	-	-	-	-	-	-	-	-	

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

FORM NO: 01-01(I) (rev. 30-JUL-07)

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LABORATORY REPORT

If you have any questions concerning this report, please do not hesitate to call us at (800) 332-4345 or (574) 233-4777.

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STATE CERTIFICATION LIST

State	Certification	State	Certification
Alabama	40700	Missouri	880
Alaska	IN00035	Montana	CERT0026
Arizona	AZ0432	Nebraska	NE-OS-05-04
Arkansas	IN00035	Nevada	IN00035
California	2920	New Hampshire*	2124
Colorado	IN035	New Jersey*	IN598
Colorado Radiochemistry	IN035	New Mexico	IN00035
Connecticut	PH-0132	New York*	11398
Delaware	IN035	North Carolina	18700
Florida*	E87775	North Dakota	R-035
Georgia	929	Ohio	87775
Hawaii	IN035	Oklahoma	D9508
Idaho	IN00035	Oregon (Primary AB)*	4074-001
Illinois*	200001	Pennsylvania*	68-00466
Illinois Microbiology	17767	Puerto Rico	IN00035
Illinois Radiochemistry	IN00035	Rhode Island	LAO00343
Indiana Chemistry	C-71-01	South Carolina	95005
Indiana Microbiology	M-76-07	South Dakota	IN00035
Iowa	098	Tennessee	TN02973
Kansas*	E-10233	Texas*	T104704187-15-8
Kentucky	90056	Texas/TCEQ	TX207
Louisiana*	LA170006	Utah*	IN00035
Maine	IN00035	Vermont	VT-8775
Maryland	209	Virginia*	460275
Massachusetts	M-IN035	Washington	C837
Michigan	9926	West Virginia	9927 C
Minnesota*	018-999-338	Wisconsin	999766900
Mississippi	IN035	Wyoming	IN035
EPA	IN00035		

*NELAP/TNI Recognized Accreditation Bodies

Revision date: 08/28/2017

eurofins | Eaton Analytical

110 South Hill Street
South Bend, IN 46617
Tel: (574) 233-4777
Fax: (574) 233-8207
1 800 332 4345

Laboratory Report

Client: Alpha Analytical

Attn: Ethan Leighton
35 Whitney Road
Suite 5
Mahwah, NJ 07430

Report: 397084
Priority: Standard Written
Status: Final
PWS ID: Not Supplied

Sample Information

EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3770528	Raw-9/L1730552-1	317.0	08/30/17 09:00	Client	09/01/17 09:45
3770529	Trojan-9/L1730552-2	317.0	08/30/17 09:00	Client	09/01/17 09:45
3770530	Filter E-9/L1730552-3	317.0	08/30/17 09:00	Client	09/01/17 09:45
3770531	Filter F-9/L1730552-4	317.0	08/30/17 09:00	Client	09/01/17 09:45

Report Summary

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call James Van Fleit at (574) 233-4777.

Note: This report may not be reproduced, except in full, without written approval from EEA.

Jim Van Fleit ASM

09/07/2017

Authorized Signature | Title | Date

Client Name: Alpha Analytical
Report #: 397084

Client Name: Alpha Analytical Report #: 397084

Sampling Point: Raw-9/L1730552-1 PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	09/06/17 03:05	3770528

Sampling Point: Trojan-9/L1730552-2 PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	09/06/17 03:30	3770529

Sampling Point: Filter E-9/L1730552-3 PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	09/06/17 03:55	3770530

Sampling Point: Filter F-9/L1730552-4 PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	09/06/17 04:20	3770531

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!

Client Name: Alpha Analytical Report #: 397084

Lab Definitions

Continuing Calibration Check Standard (CCC) / Continuing Calibration Verification (CCV) / Initial Calibration Verification Standard (ICV) / Initial Performance Check (IPC) - is a standard containing one or more of the target analytes that is prepared from the same standards used to calibrate the instrument. This standard is used to verify the calibration curve at the beginning of each analytical sequence, and may also be analyzed throughout and at the end of the sequence. The concentration of continuing standards may be varied, when prescribed by the reference method, so that the range of the calibration curve is verified on a regular basis. CCL, CCM, and CCH are the CCC standards at low, mid, and high concentration levels, respectively.

Internal Standards (IS) - are pure compounds with properties similar to the analytes of interest, which are added to field samples or extracts, calibration standards, and quality control standards at a known concentration. They are used to measure the relative responses of the analytes of interest and surrogates in the sample, calibration standard or quality control standard.

Laboratory Duplicate (LD) - is a field sample aliquot taken from the same sample container in the laboratory and analyzed separately using identical procedures. Analysis of laboratory duplicates provides a measure of the precision of the laboratory procedures.

Laboratory Fortified Blank (LFB) / Laboratory Control Sample (LCS) - is an aliquot of reagent water to which known concentrations of the analytes of interest are added. The LFB is analyzed exactly the same as the field samples. LFBs are used to determine whether the method is in control. FBL, FBM, and FBH are the LFB samples at low, mid, and high concentration levels, respectively.

Laboratory Method Blank (LMB) / Laboratory Reagent Blank (LRB) - is a sample of reagent water included in the sample batch analyzed in the same way as the associated field samples. The LMB is used to determine if method analytes or other background contamination have been introduced during the preparation or analytical procedure. The LMB is analyzed exactly the same as the field samples.

Laboratory Trip Blank (LTB) / Field Reagent Blank (FRB) - is a sample of laboratory reagent water placed in a sample container in the laboratory and treated as a field sample, including storage, preservation, and all analytical procedures. The FRB/LTB container follows the collection bottles to and from the collection site, but the FRB/LTB is not opened at any time during the trip. The FRB/LTB is primarily a travel blank used to verify that the samples were not contaminated during shipment.

Matrix Spike Duplicate Sample (MSD) / Laboratory Fortified Sample Matrix Duplicate (LFSMD) - is a sample aliquot taken from the same field sample source as the Matrix Spike Sample to which known quantities of the analytes of interest are added in the laboratory. The MSD is analyzed exactly the same as the field samples. Analysis of the MSD provides a measure of the precision of the laboratory procedures in a specific matrix. SDL, SDM, and SDH / LFSMDL, LFSMDM, and LFSMDH are the MSD or LFSMD at low, mid, and high concentration levels, respectively.

Matrix Spike Sample (MS) / Laboratory Fortified Sample Matrix (LFSM) - is a sample aliquot taken from field sample source to which known quantities of the analytes of interest are added in the laboratory. The MS is analyzed exactly the same as the field samples. The purpose is to demonstrate recovery of the analytes from a sample matrix to determine if the specific matrix contributes bias to the analytical results. MSL, MSM, and MSH / LFSML, LFSMM, and LFSMH are the MS or LFSM at low, mid, and high concentration levels, respectively.

Quality Control Standard (QCS) / Second Source Calibration Verification (SSCV) - is a solution containing known concentrations of the analytes of interest prepared from a source different from the source of the calibration standards. The solution is obtained from a second manufacturer or lot if the lot can be demonstrated by the manufacturer as prepared independently from other lots. The QCS sample is analyzed using the same procedures as field samples. The QCS is used as a check on the calibration standards used in the method on a routine basis.

Reporting Limit Check (RLC) / Initial Calibration Check Standard (ICCS) - is a procedural standard that is analyzed each day to evaluate instrument performance at or below the minimum reporting limit (MRL).

Surrogate Standard (SS) / Surrogate Analyte (SUR) - is a pure compound with properties similar to the analytes of interest, which is highly unlikely to be found in any field sample, that is added to the field samples, calibration standards, blanks and quality control standards before sample preparation. The SS is used to evaluate the efficiency of the sample preparation process.

SUB UPS: Eurofins, IN

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CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193
Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #: L1730552

Client Information

Client: Alpha Analytical Lab
Address: 8 Walkup Drive
Westborough, Ma 01581
Phone: 508-898-9220
Fax:
Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Project Information

Project Name:
Project Location: MA
Project #:
Project Manager: Ethan Leighton
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

Report Information — ☐ FAX ☐ ADEx

Data Deliverables — ☐ EMAIL ☐ Add'l Deliverables

Billing Information — ☐ Same as Client info PO #: 397084

Regulatory Requirements/Report Limits

State/Fed Program | Criteria

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☐ No Are MCP Analytical Methods Required?
☐ Yes ☐ No Are CT RCP (Reasonable Confidence Protocols) Required?

Other Project Specific Requirements/Comments/Detection Limits:
Please reference Alpha Job #L1730552 on this report.

WT

ANALYSIS

SAMPLE HANDLING
Filtration
☐ Done
☐ Not Needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Bromate	Sample Specific Comments	TOTAL # BOTTLES
3770528	RAW-9 L1730552-1	8/30/17	09:00	W		X		1
S24	TROJAN-9 -2	8/30/17	09:00	W		X		1
S30	FILTER E-9 -3	8/30/17	09:00	W		X		1
S31	FILTER F-9 -4	8/30/17	09:00	W		X		1

Container Type	P		-	-	-	-	-	-	-	-	-	-
Preservative	A		-	-	-	-	-	-	-	-	-	-

Serial_No:09181716:2B

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time
	8/31/17	KDunn 9-1-17	0945

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

FORM NO: 01-01(I) (rev. 6 JUL-07)

ANALYTICAL REPORT

Lab Number:	L1731241
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Erik Grotton
Phone:	(508) 248-7094
Project Name:	MAHER WALL PILOT
Project Number:	20107
Report Date:	09/21/17

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: MAHER WALL PILOT
Project Number: 20107

Lab Number: L1731241
Report Date: 09/21/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1731241-01	RAW-10	DW	BARNSTABLE, MA	09/06/17 09:30	09/06/17
L1731241-02	TROJAN-10	DW	BARNSTABLE, MA	09/06/17 09:30	09/06/17
L1731241-03	FILTER E-10	DW	BARNSTABLE, MA	09/06/17 09:30	09/06/17
L1731241-04	FILTER F-10	DW	BARNSTABLE, MA	09/06/17 09:30	09/06/17
L1731241-05	FIELD BLANK	DW	BARNSTABLE, MA	09/06/17 09:30	09/06/17

Project Name: MAHER WALL PILOT
Project Number: 20107
Lab Number: L1731241
Report Date: 09/21/17

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. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated 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.

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 table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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 Client Service Representative 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 Client Services at 800-624-9220 with any questions.

Project Name: MAHER WALL PILOT
Project Number: 20107
Lab Number: L1731241
Report Date: 09/21/17

Case Narrative (continued)

Report Submission

The analysis of Bromate was subcontracted. A copy of the laboratory report is included as an addendum. Please note: This data is only available in PDF format and is not available on Data Merger.

Sample Receipt

The analysis of 1,4-Dioxane by Method 522 was received unpreserved.

Perfluorinated Alkyl Acids

L1731241-05: The surrogate recovery is above the acceptance criteria for perfluoro-n-[1,2-13c2]hexanoic acid (13c-pfhxa) (135%). Since the sample was non-detect for all target analytes, re-analysis was not required.

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: Kelly Stenstrom

Title: Technical Director/Representative Date: 09/21/17

ORGANICS

SEMIVOLATILES

Project Name: MAHER WALL PILOT
Project Number: 20107
Lab Number: L1731241
Report Date: 09/21/17

SAMPLE RESULTS

Lab ID: L1731241-01
Client ID: RAW-10
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 09/20/17 20:43
Analyst: TJ

Date Collected: 09/06/17 09:30
Date Received: 09/06/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 09/20/17 11:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.407		ug/l	0.144	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	85		70-130

Project Name: MAHER WALL PILOT
Project Number: 20107
Lab Number: L1731241
Report Date: 09/21/17

SAMPLE RESULTS

Lab ID: L1731241-01
Client ID: RAW-10
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/19/17 21:32
Analyst: AR

Date Collected: 09/06/17 09:30
Date Received: 09/06/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 09/13/17 17:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	17.8		ng/l	1.67	--	1
Perfluorooctanesulfonic Acid (PFOS)	68.5		ng/l	1.67	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	108		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	114		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	102		70-130

Project Name: MAHER WALL PILOT
Project Number: 20107
Lab Number: L1731241
Report Date: 09/21/17

SAMPLE RESULTS

Lab ID: L1731241-02
Client ID: TROJAN-10
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 09/20/17 21:07
Analyst: TJ

Date Collected: 09/06/17 09:30
Date Received: 09/06/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 09/20/17 11:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.144	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	79		70-130

Project Name: MAHER WALL PILOT
Project Number: 20107
Lab Number: L1731241
Report Date: 09/21/17

SAMPLE RESULTS

Lab ID: L1731241-03
Client ID: FILTER E-10
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/19/17 21:50
Analyst: AR

Date Collected: 09/06/17 09:30
Date Received: 09/06/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 09/13/17 17:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	111		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	114		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	110		70-130

Project Name: MAHER WALL PILOT
Project Number: 20107
Lab Number: L1731241
Report Date: 09/21/17

SAMPLE RESULTS

Lab ID: L1731241-04
Client ID: FILTER F-10
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/19/17 22:09
Analyst: AR

Date Collected: 09/06/17 09:30
Date Received: 09/06/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 09/13/17 17:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.67	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.67	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	114		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	118		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	107		70-130

Project Name: MAHER WALL PILOT
Project Number: 20107
Lab Number: L1731241
Report Date: 09/21/17

SAMPLE RESULTS

Lab ID: L1731241-05
Client ID: FIELD BLANK
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/19/17 23:34
Analyst: AR

Date Collected: 09/06/17 09:30
Date Received: 09/06/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 09/13/17 17:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	**135**	Q	70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	120		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	122		70-130

Project Name: MAHER WALL PILOT
Project Number: 20107
Lab Number: L1731241
Report Date: 09/21/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 122,537
Analytical Date: 09/19/17 21:22
Analyst: AR

Extraction Method: EPA 537
Extraction Date: 09/13/17 17:00

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab for sample(s): 01,03-05 Batch: WG1041285-1					
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	112		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	115		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	117		70-130

Project Name: MAHER WALL PILOT
Project Number: 20107
Lab Number: L1731241
Report Date: 09/21/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 120,522
Analytical Date: 09/20/17 12:09
Analyst: TJ

Extraction Method: EPA 522
Extraction Date: 09/20/17 11:00

Parameter	Result	Qualifier	Units	RL	MDL
1,4 Dioxane by EPA 522 - Mansfield Lab for sample(s): 01-02 Batch: WG1043746-1					
1,4-Dioxane	ND		ug/l	0.150	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	81		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WALL PILOT

Project Number: 20107

Lab Number: L1731241

Report Date: 09/21/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01,03-05 Batch: WG1041285-2 WG1041285-3								
Perfluorooctanoic Acid (PFOA)	103		115		70-130	11		30
Perfluorooctanesulfonic Acid (PFOS)	101		109		70-130	8		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	108		110		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	110		110		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	115		115		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WALL PILOT

Project Number: 20107

Lab Number: L1731241

Report Date: 09/21/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-02 Batch: WG1043746-2 WG1043746-3								
1,4-Dioxane	76		81		70-130	6		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,4-Dioxane-d8	74		82		70-130

Matrix Spike Analysis

Batch Quality Control

Project Name: MAHER WALL PILOT

Project Number: 20107

Lab Number: L1731241

Report Date: 09/21/17

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 - Mansfield Lab Associated sample(s): 01,03-05 QC Batch ID: WG1041285-5 QC Sample: L1731241-03 Client ID: FILTER E-10												
Perfluorooctanoic Acid (PFOA)	ND	34.5	34.7	101		-	-		70-130	-		30
Perfluorooctanesulfonic Acid (PFOS)	ND	31.9	34.1	107		-	-		70-130	-		30

Surrogate	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	106				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	110				70-130
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	109				70-130

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WALL PILOT
Project Number: 20107

Lab Number: L1731241
Report Date: 09/21/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01,03-05 QC Batch ID: WG1041285-4 QC Sample: L1731241-01 Client ID: RAW-10						
Perfluorooctanoic Acid (PFOA)	17.8	18.7	ng/l	5		30
Perfluorooctanesulfonic Acid (PFOS)	68.5	69.5	ng/l	1		30

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	108		108		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	114		108		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	102		107		70-130

METALS

Project Name: MAHER WALL PILOT
Lab Number: L1731241
Project Number: 20107
Report Date: 09/21/17

SAMPLE RESULTS

Lab ID: L1731241-01
Client ID: RAW-10
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 09/06/17 09:30
Date Received: 09/06/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.087		mg/l	0.050	--	1	09/08/17 15:30	09/11/17 23:48	EPA 3005A	19,200.7	AB
Manganese, Total	0.052		mg/l	0.010	--	1	09/08/17 15:30	09/11/17 23:48	EPA 3005A	19,200.7	AB

Project Name: MAHER WALL PILOT
Project Number: 20107
Lab Number: L1731241
Report Date: 09/21/17

SAMPLE RESULTS

Lab ID: L1731241-02
Client ID: TROJAN-10
Sample Location: BARNSTABLE, MA
Matrix: Dw
Date Collected: 09/06/17 09:30
Date Received: 09/06/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.085		mg/l	0.050	--	1	09/08/17 15:30	09/11/17 23:53	EPA 3005A	19,200.7	AB
Manganese, Total	0.051		mg/l	0.010	--	1	09/08/17 15:30	09/11/17 23:53	EPA 3005A	19,200.7	AB

Project Name: MAHER WALL PILOT
Project Number: 20107
Lab Number: L1731241
Report Date: 09/21/17

SAMPLE RESULTS

Lab ID: L1731241-03
Client ID: FILTER E-10
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 09/06/17 09:30
Date Received: 09/06/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	09/08/17 15:30	09/12/17 00:17	EPA 3005A	19,200.7	AB
Manganese, Total	0.058		mg/l	0.010	--	1	09/08/17 15:30	09/12/17 00:17	EPA 3005A	19,200.7	AB

Project Name: MAHER WALL PILOT
Lab Number: L1731241
Project Number: 20107
Report Date: 09/21/17

SAMPLE RESULTS

Lab ID: L1731241-04
Client ID: FILTER F-10
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 09/06/17 09:30
Date Received: 09/06/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	09/08/17 15:30	09/12/17 00:21	EPA 3005A	19,200.7	AB
Manganese, Total	0.048		mg/l	0.010	--	1	09/08/17 15:30	09/12/17 00:21	EPA 3005A	19,200.7	AB

Project Name: MAHER WALL PILOT
Project Number: 20107
Lab Number: L1731241
Report Date: 09/21/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-04 Batch: WG1039812-1										
Iron, Total	ND		mg/l	0.050	--	1	09/08/17 15:30	09/11/17 22:20	19,200.7	AB
Manganese, Total	ND		mg/l	0.010	--	1	09/08/17 15:30	09/11/17 22:20	19,200.7	AB

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WALL PILOT

Project Number: 20107

Lab Number: L1731241

Report Date: 09/21/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 Batch: WG1039812-2								
Iron, Total	106		-		85-115	-		
Manganese, Total	100		-		85-115	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WALL PILOT
Project Number: 20107

Lab Number: L1731241
Report Date: 09/21/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1039812-3 QC Sample: L1731307-01 Client ID: MS Sample												
Iron, Total	0.167	1	1.22	105		-	-		75-125	-		20
Manganese, Total	0.013	0.5	0.522	102		-	-		75-125	-		20
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1039812-7 QC Sample: L1731371-01 Client ID: MS Sample												
Iron, Total	33.6	1	31.5	**0**	Q	-	-		75-125	-		20
Manganese, Total	0.382	0.5	0.829	89		-	-		75-125	-		20

INORGANICS
&
MISCELLANEOUS

Project Name: MAHER WALL PILOT
Project Number: 20107
Lab Number: L1731241
Report Date: 09/21/17

SAMPLE RESULTS

Lab ID: L1731241-01
Client ID: RAW-10
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 09/06/17 09:30
Date Received: 09/06/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.49		NTU	0.20	--	1	-	09/07/17 17:01	44,180.1	AS
Alkalinity, Total	13.2		mg CaCO3/L	2.00	NA	1	-	09/07/17 09:14	121,2320B	BR
pH (H)	5.6		SU	-	NA	1	-	09/07/17 12:00	121,4500H+-B	UN

Project Name: MAHER WALL PILOT
Project Number: 20107
Lab Number: L1731241
Report Date: 09/21/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1039332-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	09/07/17 09:14	121,2320B	BR
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1039460-1										
Turbidity	ND		NTU	0.20	--	1	-	09/07/17 17:01	44,180.1	AS

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WALL PILOT

Project Number: 20107

Lab Number: L1731241

Report Date: 09/21/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1039324-1								
pH	100		-		99-101	-		5
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1039332-2								
Alkalinity, Total	105		-		90-110	-		10
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1039460-2								
Turbidity	97		-		90-110	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WALL PILOT
Project Number: 20107

Lab Number: L1731241
Report Date: 09/21/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1039332-4 QC Sample: L1731153-02 Client ID: MS Sample												
Alkalinity, Total	138	100	236	98		-	-		86-116	-		10

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WALL PILOT
Project Number: 20107

Lab Number: L1731241
Report Date: 09/21/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1039324-2 QC Sample: L1731330-01 Client ID: DUP Sample						
pH	8.1	8.1	SU	0		5
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1039332-3 QC Sample: L1731153-01 Client ID: DUP Sample						
Alkalinity, Total	88.1	89.8	mg CaCO3/L	2		10
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1039460-3 QC Sample: L1731241-01 Client ID: RAW-10						
Turbidity	0.49	0.51	NTU	4		13

Project Name: MAHER WALL PILOT
Project Number: 20107

Lab Number: L1731241
Report Date: 09/21/17

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent
B	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1731241-01A	Plastic 120ml HNO3 preserved	A	<2	<2	5.6	Y	Absent		FE-UI(180),MN-UI(180)
L1731241-01B	Plastic 120ml Other preserved (sub-lab)	A	7	7	5.6	Y	Absent		SUB-BROMATE(0)
L1731241-01C	Plastic 250ml unpreserved/No Headspace	A	NA		5.6	Y	Absent		ALK-T-2320(14),TURB-180(2),PH-4500(.01)
L1731241-01D	Plastic 250ml Trizma preserved	A	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1731241-01E	Plastic 250ml Trizma preserved	A	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1731241-01F	Plastic 250ml Trizma preserved	A	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1731241-01G	Amber 500ml NaSulfite/NaHSO4 preserved	A	7	7	5.6	N	Absent		A2-14DIOXANE-522(28)
L1731241-01H	Amber 500ml NaSulfite/NaHSO4 preserved	A	7	7	5.6	N	Absent		A2-14DIOXANE-522(28)
L1731241-02A	Plastic 120ml HNO3 preserved	A	<2	<2	5.6	Y	Absent		FE-UI(180),MN-UI(180)
L1731241-02B	Plastic 120ml Other preserved (sub-lab)	A	7	7	5.6	Y	Absent		SUB-BROMATE(0)
L1731241-02G	Amber 500ml NaSulfite/NaHSO4 preserved	A	7	7	5.6	N	Absent		A2-14DIOXANE-522(28)
L1731241-02H	Amber 500ml NaSulfite/NaHSO4 preserved	A	7	7	5.6	N	Absent		A2-14DIOXANE-522(28)
L1731241-03A	Plastic 120ml HNO3 preserved	A	<2	<2	5.6	Y	Absent		FE-UI(180),MN-UI(180)
L1731241-03B	Plastic 120ml Other preserved (sub-lab)	A	7	7	5.6	Y	Absent		SUB-BROMATE(0)
L1731241-03D	Plastic 250ml Trizma preserved	A	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1731241-03E	Plastic 250ml Trizma preserved	A	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1731241-03F	Plastic 250ml Trizma preserved	A	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1731241-04A	Plastic 120ml HNO3 preserved	A	<2	<2	5.6	Y	Absent		FE-UI(180),MN-UI(180)
L1731241-04B	Plastic 120ml Other preserved (sub-lab)	A	7	7	5.6	Y	Absent		SUB-BROMATE(0)
L1731241-04D	Plastic 250ml Trizma preserved	A	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1731241-04E	Plastic 250ml Trizma preserved	A	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1731241-04F	Plastic 250ml Trizma preserved	A	NA		5.6	Y	Absent		A2-537-PFOA/PFOS(14)

*Values in parentheses indicate holding time in days

Project Name: MAHER WALL PILOT
Project Number: 20107

Lab Number: L1731241
Report Date: 09/21/17

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1731241-05A	Plastic 250ml Trizma preserved	B	NA		5.0	Y	Absent		A2-537-PFOA/PFOS(14)

*Values in parentheses indicate holding time in days

Project Name:	MAHER WALL PILOT	**Lab Number:**	L1731241
Project Number:	20107	**Report Date:**	09/21/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	MAHER WALL PILOT	**Lab Number:**	L1731241
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Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name:	MAHER WALL PILOT	**Lab Number:**	L1731241
Project Number:	20107	**Report Date:**	09/21/17

REFERENCES

19 Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

120 Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography/Mass Spectrometry (GC/MS) with Selected Ion Monitoring (SIM). EPA Method 522, EPA/600/R-08/101. Version 1.0, September 2008.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

122 Determination of Selected Perfluorintated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). EPA Method 537, EPA/600/R-08/092. Version 1.1, September 2009.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

MANSFIELD CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 09/06/17

ALPHA Job #: L1731241

WESTBORO, MA
TEL: 508-898-9220
FAX: 508-898-9193

MANSFIELD, MA
TEL: 508-822-9300
FAX: 508-822-3288

Project Information

Project Name: Maher Well Pilot
Project Location: Barnstable, MA
Project #: 20107
Project Manager: Erik Grotton
ALPHA Quote #:

Report Information - Data Deliverables

☐ FAX ☐ EMAIL
☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Client Information

Client: Blueleaf, Inc.
Address: 57 Dresser Hill Rd, Charlton, MA 01507
Phone: 774 200 8029
Fax:
Email: egrotton@blueleafwater.com

☐ These samples have been previously analyzed by Alpha

Regulatory Requirements/Report Limits

State /Fed Program | Criteria

Turn-Around Time

☐ Standard ☐ RUSH (only confirmed if pre-approved!)

Date Due: Time:

Other Project Specific Requirements/Comments/Detection Limits:

PLEASE NOTE
MS/MSD (at unit cost) will be omitted unless you check here: ☐

ANALYSIS: Total Fe + Mn; Alk, pH, Turb; Bromide; 1,4 Dioxane; PFOC PFOA

SAMPLE HANDLING
Filtration ________
☐ Done
☐ Not needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Total Fe + Mn	Alk, pH, Turb	Bromide	1,4 Dioxane	PFOC PFOA							Sample Specific Comments	TOTAL # BOTTLES
31241-01	Raw - 10	9/6/17	9:30	DW	ARD	X	X	X	X	X								8
02	Trojan - 10	↓	↓	↓	↓	X		X	X									4
03	Filter E - 10	↓	↓	↓	↓	X		X		X								5
04	Filter F - 10	↓	↓	↓	↓	X		X		X								5
05	Field Blank	↓	↓	↓	↓	~~X~~				X								1

Container Type	
Preservative	

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	9/6/17 13:27	[signature] AAL	9/6/17 1327

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Terms and Conditions.
See reverse side.

FORM NO: 101-09 (rev. 27-SEP-10)

MANSFIELD CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL
WESTBORO, MA TEL: 508-898-9220 FAX: 508-898-9193
MANSFIELD, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab: 09/06/17

ALPHA Job #: L1731241

Client Information

Client: Blueleaf, Inc.
Address: 57 Dresser Hill Rd.
Charlton, MA 01507
Phone: 774 200 8029
Fax:
Email: egrotton@blueleafwater.com
☐ These samples have been previously analyzed by Alpha

Project Information

Project Name: Maher Well Pilot
Project Location: Barnstable, MA
Project #: 20107
Project Manager: Erik Grotton
ALPHA Quote #:

Turn-Around Time

☐ Standard ☐ RUSH (only confirmed if pre-approved!)
Date Due: Time:

Report Information - Data Deliverables

☐ FAX ☐ EMAIL
☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State /Fed Program | Criteria

Other Project Specific Requirements/Comments/Detection Limits:

PLEASE NOTE
MS/MSD (at unit cost) will be omitted unless you check here: ☐

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	ANALYSIS: Total Fe + Mn	Alk, pH, Turb	Bromide, Tc	1,4 Dioxane 8270C-SIM 0.4	SAMPLE HANDLING	TOTAL # BOTTLES
31241-01	Raw - 10	9/6/17	9:30	DW	AED	X	X	X	X	X	8
02	Trojan - 10					X		X	X		4
03	Filter E - 10					X		X		X	5
04	Filter F - 10					X		X		X	5
05	Field Blank	↓	↓	↓	↓	X					1

SAMPLE HANDLING
Filtration
☐ Done
☐ Not needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

Sample Specific Comments

Container Type
Preservative

Relinquished By:	Date/Time	Received By:	Date/Time
9/6/17	13:27	AAL	9/6/17 1327

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

SUB UPS: **Eurofins, IN**

CHAIN OF CUSTODY

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193
Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Client Information

Client: Alpha Analytical Lab
Address: 8 Walkup Drive
Westborough, Ma 01581
Phone: 508-898-9220
Fax:
Email: subreports@alphalab.com
☐ These samples have been Previously analyzed by Alpha

Project Information

Project Name:
Project Location: MA
Project #:
Project Manager: Ethan Leighton
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)
Due Date: Time:

Other Project Specific Requirements/Comments/Detection Limits:
Please reference Alpha Job # **L1731241** on this report.

Date Rec'd in Lab:

ALPHA Job #:L1731241

Report Information Data Deliverables

☐ FAX ☐ EMAIL
☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program *Criteria*

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☒ No Are MCP Analytical Methods Required?
☐ Yes ☒ No Are CT RCP (Reasonable Confidence Protocols) Required?

ANALYSIS

SAMPLE HANDLING
Filtration
☐ Done
☐ Not Needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	BROMATE												Sample Specific Comments	TOTAL # BOTTLES
	RAW-10	9/6/17	09:30	DW		X													1
	TROJAN-10	9/6/17	09:30	DW		X													1
	FILTER E-10	9/6/17	09:30	DW		X													1
	FILTER F-10	9/6/17	09:30	DW		X													1

Container Type	P		-	-	-	-	-	-	-	-	-	-
Preservative	EDA		-	-	-	-	-	-	-	-	-	-

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

FORM NO: 01-01(I) (rev. 30-JUL-07)

SUB UPS: **Eurofins, IN**

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193
Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #:L1731241

Project Information

Project Name:

Project Location: MA

Project #:

Project Manager: Ethan Leighton

ALPHA Quote #:

Report Information Data Deliverables

☐ FAX ☐ EMAIL

☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program *Criteria*

Client Information

Client: Alpha Analytical Lab

Address: 8 Walkup Drive

Westborough, Ma 01581

Phone: 508-898-9220

Fax:

Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☒ No Are MCP Analytical Methods Required?

☐ Yes ☒ No Are CT RCP (Reasonable Confidence Protocols) Required?

Other Project Specific Requirements/Comments/Detection Limits:

Please reference Alpha Job # **L1731241** on this report.

ANALYSIS

SAMPLE HANDLING
Filtration
☐ Done
☐ Not Needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

Sample Specific Comments

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	BROMATE												TOTAL # BOTTLES
	RAW-10	9/6/17	09:30	DW		X												1
	TROJAN-10	9/6/17	09:30	DW		X												1
	FILTER E-10	9/6/17	09:30	DW		X												1
	FILTER F-10	9/6/17	09:30	DW		X												1

Container Type	P		-	-	-	-	-	-	-	-	-	-
Preservative	EDA		-	-	-	-	-	-	-	-	-	-

PLEASE ANSWER QUESTIONS ABOVE!

S YOUR PROJECT MA MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time
AAR	9/7/17		

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

FORM NO: 01-01(I)
(rev. 30-JUL-07)

Shipment Receipt

Transaction Date: 07 Sep 2017 **Tracking Number:** 1ZE306540198685876

1 ADDRESS INFORMATION

Ship To:
Eurofins Eaton Analytical
110 South Hill Street
SOUTH BEND IN 466172702
Telephone:574-233-4777

Ship From:
Walkup
Login Dept Westboro
8 Walkup Dr
Westborough MA 01581
Telephone:508-898-9220
email:login@alphalab.com

Return Address:
Walkup
Login Dept Westboro
8 Walkup Dr
Westborough MA 01581
Telephone:508-898-9220 email:login@alphalab.com

2 PACKAGE INFORMATION

	WEIGHT	DIMENSIONS / PACKAGING	DECLARED VALUE	REFERENCE NUMBERS
1.	31.0 lbs (31.0 lbs billable)	18 x 16 x 13in. Other Packaging	100.00 USD	

3 UPS SHIPPING SERVICE AND SHIPPING OPTIONS

Service: UPS Next Day Air
Guaranteed By: 10:30 AM Friday, Sep 8, 2017
Shipping Fees Subtotal: 224.84 USD

Transportation	213.62 USD
Fuel Surcharge	11.22 USD
Declared Value	
Package 1	0.00 USD

4 PAYMENT INFORMATION

Bill Shipping Charges to: Shipper's Account E30654

Shipping Charges:	224.84 USD
A discount has been applied to the Daily rates for this shipment **Negotiated Charges:**	83.19 USD
Subtotal Shipping Charges:	83.19 USD
Total Charges:	83.19 USD

Note: This document is not an invoice. Your final invoice may vary from the displayed reference rates.

* For delivery and guarantee information, see the UPS Service Guide ({0}). To speak to a customer service representative, call 1-800-PICK-UPS for domestic services and 1-800-782-7892 for international services.

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LABORATORY REPORT

If you have any questions concerning this report, please do not hesitate to call us at (800) 332-4345 or (574) 233-4777.

eurofins | Eaton Analytical

STATE CERTIFICATION LIST

State	Certification	State	Certification
Alabama	40700	Missouri	880
Alaska	IN00035	Montana	CERT0026
Arizona	AZ0432	Nebraska	NE-OS-05-04
Arkansas	IN00035	Nevada	IN00035
California	2920	New Hampshire*	2124
Colorado	IN035	New Jersey*	IN598
Colorado Radiochemistry	IN035	New Mexico	IN00035
Connecticut	PH-0132	New York*	11398
Delaware	IN035	North Carolina	18700
Florida*	E87775	North Dakota	R-035
Georgia	929	Ohio	87775
Hawaii	IN035	Oklahoma	D9508
Idaho	IN00035	Oregon (Primary AB)*	4074-001
Illinois*	200001	Pennsylvania*	68-00466
Illinois Microbiology	17767	Puerto Rico	IN00035
Illinois Radiochemistry	IN00035	Rhode Island	LAO00343
Indiana Chemistry	C-71-01	South Carolina	95005
Indiana Microbiology	M-76-07	South Dakota	IN00035
Iowa	098	Tennessee	TN02973
Kansas*	E-10233	Texas*	T104704187-15-8
Kentucky	90056	Texas/TCEQ	TX207
Louisiana*	LA170006	Utah*	IN00035
Maine	IN00035	Vermont	VT-8775
Maryland	209	Virginia*	460275
Massachusetts	M-IN035	Washington	C837
Michigan	9926	West Virginia	9927 C
Minnesota*	018-999-338	Wisconsin	999766900
Mississippi	IN035	Wyoming	IN035
EPA	IN00035		

*NELAP/TNI Recognized Accreditation Bodies

Revision date: 08/28/2017

eurofins | Eaton Analytical

110 South Hill Street
South Bend, IN 46617
Tel: (574) 233-4777
Fax: (574) 233-8207
1 800 332 4345

Laboratory Report

Client: Alpha Analytical

Attn: Ethan Leighton
35 Whitney Road
Suite 5
Mahwah, NJ 07430

Report: 397615
Priority: Standard Written
Status: Final
PWS ID: Not Supplied

Sample Information

EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3774352	L1731241-1/Raw-10	317.0	09/06/17 09:30	Client	09/11/17 08:45
3774353	L1731241-2/Trojan-10	317.0	09/06/17 09:30	Client	09/11/17 08:45
3774354	L1731241-3/Filter E-10	317.0	09/06/17 09:30	Client	09/11/17 08:45
3774355	L1731241-4/Filter F-10	317.0	09/06/17 09:30	Client	09/11/17 08:45

Report Summary

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call James Van Fleit at (574) 233-4777.

Note: This report may not be reproduced, except in full, without written approval from EEA.

Jim Van Fleit ASM

09/15/2017

Authorized Signature | Title | Date

Client Name: Alpha Analytical
Report #: 397615

Client Name: Alpha Analytical

Report #: 397615

Sampling Point: L1731241-1/Raw-10

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	09/13/17 09:34	3774352

Sampling Point: L1731241-2/Trojan-10

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	09/13/17 09:59	3774353

Sampling Point: L1731241-3/Filter E-10

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	09/13/17 10:24	3774354

Sampling Point: L1731241-4/Filter F-10

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	09/13/17 10:49	3774355

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!

Client Name: Alpha Analytical Report #: 397615

Lab Definitions

Continuing Calibration Check Standard (CCC) / Continuing Calibration Verification (CCV) / Initial Calibration Verification Standard (ICV) / Initial Performance Check (IPC) - is a standard containing one or more of the target analytes that is prepared from the same standards used to calibrate the instrument. This standard is used to verify the calibration curve at the beginning of each analytical sequence, and may also be analyzed throughout and at the end of the sequence. The concentration of continuing standards may be varied, when prescribed by the reference method, so that the range of the calibration curve is verified on a regular basis. CCL, CCM, and CCH are the CCC standards at low, mid, and high concentration levels, respectively.

Internal Standards (IS) - are pure compounds with properties similar to the analytes of interest, which are added to field samples or extracts, calibration standards, and quality control standards at a known concentration. They are used to measure the relative responses of the analytes of interest and surrogates in the sample, calibration standard or quality control standard.

Laboratory Duplicate (LD) - is a field sample aliquot taken from the same sample container in the laboratory and analyzed separately using identical procedures. Analysis of laboratory duplicates provides a measure of the precision of the laboratory procedures.

Laboratory Fortified Blank (LFB) / Laboratory Control Sample (LCS) - is an aliquot of reagent water to which known concentrations of the analytes of interest are added. The LFB is analyzed exactly the same as the field samples. LFBs are used to determine whether the method is in control. FBL, FBM, and FBH are the LFB samples at low, mid, and high concentration levels, respectively.

Laboratory Method Blank (LMB) / Laboratory Reagent Blank (LRB) - is a sample of reagent water included in the sample batch analyzed in the same way as the associated field samples. The LMB is used to determine if method analytes or other background contamination have been introduced during the preparation or analytical procedure. The LMB is analyzed exactly the same as the field samples.

Laboratory Trip Blank (LTB) / Field Reagent Blank (FRB) - is a sample of laboratory reagent water placed in a sample container in the laboratory and treated as a field sample, including storage, preservation, and all analytical procedures. The FRB/LTB container follows the collection bottles to and from the collection site, but the FRB/LTB is not opened at any time during the trip. The FRB/LTB is primarily a travel blank used to verify that the samples were not contaminated during shipment.

Matrix Spike Duplicate Sample (MSD) / Laboratory Fortified Sample Matrix Duplicate (LFSMD) - is a sample aliquot taken from the same field sample source as the Matrix Spike Sample to which known quantities of the analytes of interest are added in the laboratory. The MSD is analyzed exactly the same as the field samples. Analysis of the MSD provides a measure of the precision of the laboratory procedures in a specific matrix. SDL, SDM, and SDH / LFSMDL, LFSMDM, and LFSMDH are the MSD or LFSMD at low, mid, and high concentration levels, respectively.

Matrix Spike Sample (MS) / Laboratory Fortified Sample Matrix (LFSM) - is a sample aliquot taken from field sample source to which known quantities of the analytes of interest are added in the laboratory. The MS is analyzed exactly the same as the field samples. The purpose is to demonstrate recovery of the analytes from a sample matrix to determine if the specific matrix contributes bias to the analytical results. MSL, MSM, and MSH / LFSML, LFSMM, and LFSMH are the MS or LFSM at low, mid, and high concentration levels, respectively.

Quality Control Standard (QCS) / Second Source Calibration Verification (SSCV) - is a solution containing known concentrations of the analytes of interest prepared from a source different from the source of the calibration standards. The solution is obtained from a second manufacturer or lot if the lot can be demonstrated by the manufacturer as prepared independently from other lots. The QCS sample is analyzed using the same procedures as field samples. The QCS is used as a check on the calibration standards used in the method on a routine basis.

Reporting Limit Check (RLC) / Initial Calibration Check Standard (ICCS) - is a procedural standard that is analyzed each day to evaluate instrument performance at or below the minimum reporting limit (MRL).

Surrogate Standard (SS) / Surrogate Analyte (SUR) - is a pure compound with properties similar to the analytes of interest, which is highly unlikely to be found in any field sample, that is added to the field samples, calibration standards, blanks and quality control standards before sample preparation. The SS is used to evaluate the efficiency of the sample preparation process.

SUB UPS: **Eurofins, IN**

397615

326246

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193

Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #:L1731241

Project Information

Project Name:

Project Location: MA

Project #:

Project Manager: Ethan Leighton

ALPHA Quote #:

Report Information Data Deliverables

☐ FAX ☐ EMAIL

☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program *Criteria*

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☒ No Are MCP Analytical Methods Required?

☐ Yes ☒ No Are CT RCP (Reasonable Confidence Protocols) Required?

Client Information

Client: Alpha Analytical Lab

Address: 8 Walkup Drive

Westborough, Ma 01581

Phone: 508-898-9220

Fax:

Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

Other Project Specific Requirements/Comments/Detection Limits:

Please reference Alpha Job # **L1731241** on this report.

ANALYSIS

SAMPLE HANDLING

Filtration

☐ Done

☐ Not Needed

☐ Lab to do

Preservation

☐ Lab to do

(Please specify below)

wet 2.8 °C

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	BROMATE	Sample Specific Comments	TOTAL # BOTTLES
	RAW-10	9/6/17	09:30	DW		X	377352	1
	TROJAN-10	9/6/17	09:30	DW		X	353	1
	FILTER E-10	9/6/17	09:30	DW		X	354	1
	FILTER F-10	9/6/17	09:30	DW		X	355	1

Container Type	P		-	-	-	-	-	-	-	-	-	-
Preservative	EDA		-	-	-	-	-	-	-	-	-	-

EASE ANSWER QUESTIONS ABOVE!

S YOUR PROJECT A MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time
AAR	9/7/17	KDW	9-8-17 0846

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

ANALYTICAL REPORT

Lab Number:	L1732361
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Erik Grotton
Phone:	(508) 248-7094
Project Name:	MAHER WELL PILOT
Project Number:	20107
Report Date:	10/03/17

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1732361
Report Date: 10/03/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1732361-01	RAW-11	DW	BARNSTABLE, MA	09/13/17 10:00	09/13/17
L1732361-02	TROJAN-11	DW	BARNSTABLE, MA	09/13/17 10:00	09/13/17
L1732361-03	FILTER E-11	DW	BARNSTABLE, MA	09/13/17 10:00	09/13/17
L1732361-04	FILTER F-11	DW	BARNSTABLE, MA	09/13/17 10:00	09/13/17

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1732361
Report Date: 10/03/17

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. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated 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.

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 table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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 Client Service Representative 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 Client Services at 800-624-9220 with any questions.

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1732361
Project Number:	20107	**Report Date:**	10/03/17

Case Narrative (continued)

Report Submission

The analysis of Bromate was subcontracted. A copy of the laboratory report is included as an addendum. Please note: This data is only available in PDF format and is not available on Data Merger.

Sample Receipt

L1732361-01 and -02: One of the sample vials was received above the appropriate pH for the 1,4-Dioxane analysis.

Perfluorinated Alkyl Acids

The surrogate recovery for the following samples was outside the acceptance criteria for n-deuterioethylperfluoro-1-octanesulfonamidoacetic acid (d5-netfosaa); however, re-analysis achieved similar results. The results of the original analyses are reported:

L1732361-01: 146%

L1732361-03: 144%

L1732361-04: 147%

WG1043307-5:165%

WG1043307-4: 178%

WG1043307-1: The surrogate recovery for n-deuterioethylperfluoro-1-octanesulfonamidoacetic acid (d5-netfosaa) (132%) is outside the acceptance criteria; however, since the sample was non-detect for all target analytes associated with this surrogate, re-analysis was not required.

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:  Kelly Stenstrom

Title: Technical Director/Representative Date: 10/03/17

ORGANICS

SEMIVOLATILES

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1732361
Report Date: 10/03/17

SAMPLE RESULTS

Lab ID: L1732361-01
Client ID: RAW-11
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 09/20/17 21:54
Analyst: TJ

Date Collected: 09/13/17 10:00
Date Received: 09/13/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 09/20/17 11:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.152		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	91		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1732361
Report Date: 10/03/17

SAMPLE RESULTS

Lab ID: L1732361-01
Client ID: RAW-11
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/26/17 23:08
Analyst: AJ

Date Collected: 09/13/17 10:00
Date Received: 09/13/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 09/19/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	20.2		ng/l	1.78	--	1
Perfluorooctanesulfonic Acid (PFOS)	72.8		ng/l	1.78	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	92		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	108		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	**146**	Q	70-130

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1732361
Report Date: 10/03/17

SAMPLE RESULTS

Lab ID: L1732361-02
Client ID: TROJAN-11
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 09/20/17 22:18
Analyst: TJ

Date Collected: 09/13/17 10:00
Date Received: 09/13/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 09/20/17 11:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	83		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1732361
Report Date: 10/03/17

SAMPLE RESULTS

Lab ID: L1732361-03
Client ID: FILTER E-11
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 09/20/17 22:41
Analyst: TJ

Date Collected: 09/13/17 10:00
Date Received: 09/13/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 09/20/17 11:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	96		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1732361
Report Date: 10/03/17

SAMPLE RESULTS

Lab ID: L1732361-03
Client ID: FILTER E-11
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/26/17 23:38
Analyst: AJ

Date Collected: 09/13/17 10:00
Date Received: 09/13/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 09/19/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	100		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	121		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	**144**	Q	70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1732361
Report Date: 10/03/17

SAMPLE RESULTS

Lab ID: L1732361-04
Client ID: FILTER F-11
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 09/20/17 23:28
Analyst: TJ

Date Collected: 09/13/17 10:00
Date Received: 09/13/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 09/20/17 11:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.144	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	75		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1732361
Report Date: 10/03/17

SAMPLE RESULTS

Lab ID: L1732361-04
Client ID: FILTER F-11
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/27/17 00:08
Analyst: AJ

Date Collected: 09/13/17 10:00
Date Received: 09/13/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 09/19/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	101		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	114		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	**147**	Q	70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1732361
Report Date: 10/03/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 122,537
Analytical Date: 09/26/17 22:53
Analyst: AJ

Extraction Method: EPA 537
Extraction Date: 09/19/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab for sample(s): 01,03-04 Batch: WG1043307-1					
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	106		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	122		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	**132**	Q	70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1732361
Report Date: 10/03/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 120,522
Analytical Date: 09/20/17 12:09
Analyst: TJ

Extraction Method: EPA 522
Extraction Date: 09/20/17 11:00

Parameter	Result	Qualifier	Units	RL	MDL
1,4 Dioxane by EPA 522 - Mansfield Lab for sample(s): 01-04 Batch: WG1043746-1					
1,4-Dioxane	ND		ug/l	0.150	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	81		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1732361

Report Date: 10/03/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01,03-04 Batch: WG1043307-2 WG1043307-3								
Perfluorooctanoic Acid (PFOA)	113		119		70-130	5		30
Perfluorooctanesulfonic Acid (PFOS)	104		111		70-130	7		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	102		98		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	114		109		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	126		128		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1732361

Report Date: 10/03/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-04 Batch: WG1043746-2 WG1043746-3								
1,4-Dioxane	76		81		70-130	6		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,4-Dioxane-d8	74		82		70-130

Matrix Spike Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1732361

Report Date: 10/03/17

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 - Mansfield Lab Associated sample(s): 01,03-04 QC Batch ID: WG1043307-5 QC Sample: L1732361-03 Client ID: FILTER E-11												
Perfluorooctanoic Acid (PFOA)	ND	34.5	40.4	117		-	-		70-130	-		30
Perfluorooctanesulfonic Acid (PFOS)	ND	31.9	33.8	106		-	-		70-130	-		30

Surrogate	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	**165**	Q			70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	123				70-130
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	100				70-130

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1732361
Report Date: 10/03/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01,03-04 QC Batch ID: WG1043307-4 QC Sample: L1732361-01 Client ID: RAW-11						
Perfluorooctanoic Acid (PFOA)	20.2	19.9	ng/l	1		30
Perfluorooctanesulfonic Acid (PFOS)	72.8	84.2	ng/l	15		30

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	92		99		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	108		115		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	**146**	Q	**178**	Q	70-130

METALS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1732361
Report Date: 10/03/17

SAMPLE RESULTS

Lab ID: L1732361-01
Client ID: RAW-11
Sample Location: BARNSTABLE, MA
Matrix: Dw
Date Collected: 09/13/17 10:00
Date Received: 09/13/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.096		mg/l	0.050	--	1	09/18/17 17:55	09/21/17 11:43	EPA 3005A	19,200.7	PS
Manganese, Total	0.048		mg/l	0.010	--	1	09/18/17 17:55	09/21/17 11:43	EPA 3005A	19,200.7	PS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1732361
Report Date: 10/03/17

SAMPLE RESULTS

Lab ID: L1732361-02
Client ID: TROJAN-11
Sample Location: BARNSTABLE, MA
Matrix: Dw
Date Collected: 09/13/17 10:00
Date Received: 09/13/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.120		mg/l	0.050	--	1	09/18/17 17:55	09/21/17 16:35	EPA 3005A	19,200.7	PS
Manganese, Total	0.048		mg/l	0.010	--	1	09/18/17 17:55	09/21/17 16:35	EPA 3005A	19,200.7	PS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1732361
Report Date: 10/03/17

SAMPLE RESULTS

Lab ID: L1732361-03
Client ID: FILTER E-11
Sample Location: BARNSTABLE, MA
Matrix: Dw
Date Collected: 09/13/17 10:00
Date Received: 09/13/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	09/18/17 17:55	09/21/17 16:40	EPA 3005A	19,200.7	PS
Manganese, Total	0.042		mg/l	0.010	--	1	09/18/17 17:55	09/21/17 16:40	EPA 3005A	19,200.7	PS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1732361
Report Date: 10/03/17

SAMPLE RESULTS

Lab ID: L1732361-04
Client ID: FILTER F-11
Sample Location: BARNSTABLE, MA
Matrix: Dw
Date Collected: 09/13/17 10:00
Date Received: 09/13/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	09/18/17 17:55	09/21/17 16:44	EPA 3005A	19,200.7	PS
Manganese, Total	0.041		mg/l	0.010	--	1	09/18/17 17:55	09/21/17 16:44	EPA 3005A	19,200.7	PS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1732361
Report Date: 10/03/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-04 Batch: WG1042851-1										
Iron, Total	ND		mg/l	0.050	--	1	09/18/17 17:55	09/21/17 11:35	19,200.7	PS
Manganese, Total	ND		mg/l	0.010	--	1	09/18/17 17:55	09/21/17 11:35	19,200.7	PS

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1732361

Report Date: 10/03/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 Batch: WG1042851-2								
Iron, Total	106		-		85-115	-		
Manganese, Total	100		-		85-115	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1732361
Report Date: 10/03/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1042851-3 QC Sample: L1732361-01 Client ID: RAW-11												
Iron, Total	0.096	2	2.24	107		-	-		75-125	-		20
Manganese, Total	0.048	1	1.04	99		-	-		75-125	-		20
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1042851-7 QC Sample: L1732582-01 Client ID: MS Sample												
Iron, Total	1.53	2	3.82	114		-	-		75-125	-		20
Manganese, Total	0.042	1	1.08	104		-	-		75-125	-		20

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1732361
Report Date: 10/03/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1042851-4 QC Sample: L1732361-01 Client ID: RAW-11						
Iron, Total	0.096	0.091	mg/l	5		20
Manganese, Total	0.048	0.047	mg/l	3		20

INORGANICS
&
MISCELLANEOUS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1732361
Report Date: 10/03/17

SAMPLE RESULTS

Lab ID: L1732361-01
Client ID: RAW-11
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 09/13/17 10:00
Date Received: 09/13/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.52		NTU	0.20	--	1	-	09/14/17 20:35	44,180.1	AS
Alkalinity, Total	13.2		mg CaCO3/L	2.00	NA	1	-	09/13/17 23:11	121,2320B	MR
pH (H)	6.4		SU	-	NA	1	-	09/14/17 12:25	121,4500H+-B	JT

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1732361
Report Date: 10/03/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1041435-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	09/13/17 23:11	121,2320B	MR
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1041871-1										
Turbidity	ND		NTU	0.20	--	1	-	09/14/17 20:35	44,180.1	AS

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1732361

Report Date: 10/03/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1041435-2								
Alkalinity, Total	105		-		90-110	-		10
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1041762-1								
pH	100		-		99-101	-		5
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1041871-2								
Turbidity	110		-		90-110	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1732361
Report Date: 10/03/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1041435-4 QC Sample: L1732333-01 Client ID: MS Sample												
Alkalinity, Total	40.4	100	139	99		-	-		86-116	-		10

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1732361
Report Date: 10/03/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1041435-3 QC Sample: L1732333-01 Client ID: DUP Sample						
Alkalinity, Total	40.4	39.8	mg CaCO3/L	1		10
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1041762-2 QC Sample: L1732444-01 Client ID: DUP Sample						
pH	7.4	7.4	SU	0		5
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1041871-3 QC Sample: L1732361-01 Client ID: RAW-11						
Turbidity	0.52	0.48	NTU	8		13

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1732361
Report Date: 10/03/17

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(*)
L1732361-01A	Plastic 120ml HNO3 preserved	A	<2	<2	4.9	Y	Absent		FE-UI(180),MN-UI(180)
L1732361-01B	Plastic 120ml Other preserved (sub-lab)	A	7	7	4.9	Y	Absent		SUB-BROMATE()
L1732361-01C	Plastic 250ml unpreserved/No Headspace	A	NA		4.9	Y	Absent		ALK-T-2320(14),TURB-180(2),PH-4500(.01)
L1732361-01D	Plastic 250ml Trizma preserved	A	NA		4.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1732361-01E	Plastic 250ml Trizma preserved	A	NA		4.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1732361-01F	Plastic 250ml Trizma preserved	A	NA		4.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1732361-01G	Amber 500ml NaSulfite/NaHSO4 preserved	A	6	6	4.9	N	Absent		A2-14DIOXANE-522(28)
L1732361-01H	Amber 500ml NaSulfite/NaHSO4 preserved	A	3	3	4.9	Y	Absent		A2-14DIOXANE-522(28)
L1732361-02A	Plastic 120ml HNO3 preserved	A	<2	<2	4.9	Y	Absent		FE-UI(180),MN-UI(180)
L1732361-02B	Plastic 120ml Other preserved (sub-lab)	A	7	7	4.9	Y	Absent		SUB-BROMATE()
L1732361-02G	Amber 500ml NaSulfite/NaHSO4 preserved	A	6	6	4.9	N	Absent		A2-14DIOXANE-522(28)
L1732361-02H	Amber 500ml NaSulfite/NaHSO4 preserved	A	3	3	4.9	Y	Absent		A2-14DIOXANE-522(28)
L1732361-03A	Plastic 120ml HNO3 preserved	A	<2	<2	4.9	Y	Absent		FE-UI(180),MN-UI(180)
L1732361-03B	Plastic 120ml Other preserved (sub-lab)	A	7	7	4.9	Y	Absent		SUB-BROMATE()
L1732361-03D	Plastic 250ml Trizma preserved	A	NA		4.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1732361-03E	Plastic 250ml Trizma preserved	A	NA		4.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1732361-03F	Plastic 250ml Trizma preserved	A	NA		4.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1732361-03G	Amber 500ml NaSulfite/NaHSO4 preserved	A	3	3	4.9	Y	Absent		A2-14DIOXANE-522(28)
L1732361-03H	Amber 500ml NaSulfite/NaHSO4 preserved	A	3	3	4.9	Y	Absent		A2-14DIOXANE-522(28)
L1732361-04A	Plastic 120ml HNO3 preserved	A	<2	<2	4.9	Y	Absent		FE-UI(180),MN-UI(180)
L1732361-04B	Plastic 120ml Other preserved (sub-lab)	A	7	7	4.9	Y	Absent		SUB-BROMATE()
L1732361-04D	Plastic 250ml Trizma preserved	A	NA		4.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1732361-04E	Plastic 250ml Trizma preserved	A	NA		4.9	Y	Absent		A2-537-PFOA/PFOS(14)

*Values in parentheses indicate holding time in days

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1732361
Report Date: 10/03/17

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1732361-04F	Plastic 250ml Trizma preserved	A	NA		4.9	Y	Absent		A2-537-PFOA/PFOS(14)
L1732361-04G	Amber 500ml NaSulfite/NaHSO4 preserved	A	3	3	4.9	Y	Absent		A2-14DIOXANE-522(28)
L1732361-04H	Amber 500ml NaSulfite/NaHSO4 preserved	A	3	3	4.9	Y	Absent		A2-14DIOXANE-522(28)

*Values in parentheses indicate holding time in days

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1732361
Project Number:	20107	**Report Date:**	10/03/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1732361
Project Number:	20107	**Report Date:**	10/03/17

Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1732361
Project Number:	20107	**Report Date:**	10/03/17

REFERENCES

19 Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

120 Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography/Mass Spectrometry (GC/MS) with Selected Ion Monitoring (SIM). EPA Method 522, EPA/600/R-08/101. Version 1.0, September 2008.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

122 Determination of Selected Perfluorintated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). EPA Method 537, EPA/600/R-08/092. Version 1.1, September 2009.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 9/13/17

ALPHA Job #: L1732361

ALPHA ANALYTICAL
World Class Chemistry
8 Walkup Drive, Westboro, MA 01581, Tel: 508-898-9220
320 Forbes Blvd, Mansfield, MA 02048, Tel: 508-822-9300

Client Information

Client: Bluelect, Inc.
Address: 57 Dresser Hill Rd. Charlton MA 01507
Phone: 508 294 3714
Email: egrotton@bluelectwater.com

Additional Project Information:

Project Information

Project Name: Maher Well Pilot
Project Location: Barnstable, MA
Project #: 20107
Project Manager: Erik Grotton
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved)
Date Due:

Report Information - Data Deliverables

☒ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	VOC: ☐ 8260 ☐ 624 ☐ 524.2	SVOC: ☐ ABN ☐ PAH	METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15	METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13	EPH: ☐ Ranges & Targets ☐ Ranges Only	VPH: ☐ Ranges & Targets ☐ Ranges Only	☐ PCB ☐ PEST	TPH: ☐ Quant Only ☐ Fingerprint	Total Fe + Mn	pH, Alky, Turbidity	Bromate	1,4 Dioxane	PFOS/PFOA	Sample Comments	TOTAL # BOTTLES
32361-01	Raw-11	9/13/17	10:00	DW	AHD									X	X	X	X	X		8
02	Trojan-11	↓	↓	↓	↓									X		X	X			4
03	Filter E-11													X		X	X	X		7
04	Filter F-11													X		X	X	X		7

SAMPLE INFO
Filtration
☐ Field
☐ Lab to do
Preservation
☐ Lab to do

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

	Container Type																			
	Preservative																			

Relinquished By:	Date/Time	Received By:	Date/Time
	9/13/17 14:15	AM	9/13/17 14:15

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

SUB UPS: Eurofins, IN

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA
TEL: 508-898-9220
FAX: 508-898-9193

Mansfield, MA
TEL: 508-822-9300
FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #: L1732361

Client Information

Client: Alpha Analytical Lab
Address: 8 Walkup Drive
Westborough, Ma 01581
Phone: 508-898-9220
Fax:
Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Project Information

Project Name:
Project Location: MA
Project #:
Project Manager: Ethan Leighton
ALPHA Quote #:

Turn-Around Time

☐ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

Other Project Specific Requirements/Comments/Detection Limits:
Please reference Alpha Job #L1732361 on this report.

Report Information Data Deliverables

☐ FAX ☐ EMAIL
☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program | Criteria

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☐ No Are MCP Analytical Methods Required?
☐ Yes ☐ No Are CT RCP (Reasonable Confidence Protocols) Required?

ANALYSIS

SAMPLE HANDLING
Filtration
☐ Done
☐ Not Needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Bromate	Sample Specific Comments	TOTAL # BOTTLES
	RAW-11	9/13/17	10:00	DW		X		1
	TROJAN-11	9/13/17	10:00	DW		X		1
	FILTER E-11	9/13/17	10:00	DW		X		1
	FILTER F-11	9/13/17	10:00	DW		X		1

Container Type	P		-	-	-	-	-	-	-	-	-	-
Preservative	O		-	-	-	-	-	-	-	-	-	-

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time
	9/14/17		

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

FORM NO: 01-01(I)
(rev. 30-JUL-07)

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LABORATORY REPORT

If you have any questions concerning this report, please do not hesitate to call us at (800) 332-4345 or (574) 233-4777.

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STATE CERTIFICATION LIST

State	Certification	State	Certification
Alabama	40700	Missouri	880
Alaska	IN00035	Montana	CERT0026
Arizona	AZ0432	Nebraska	NE-OS-05-04
Arkansas	IN00035	Nevada	IN00035
California	2920	New Hampshire*	2124
Colorado	IN035	New Jersey*	IN598
Colorado Radiochemistry	IN035	New Mexico	IN00035
Connecticut	PH-0132	New York*	11398
Delaware	IN035	North Carolina	18700
Florida*	E87775	North Dakota	R-035
Georgia	929	Ohio	87775
Hawaii	IN035	Oklahoma	D9508
Idaho	IN00035	Oregon (Primary AB)*	4074-001
Illinois*	200001	Pennsylvania*	68-00466
Illinois Microbiology	17767	Puerto Rico	IN00035
Illinois Radiochemistry	IN00035	Rhode Island	LAO00343
Indiana Chemistry	C-71-01	South Carolina	95005
Indiana Microbiology	M-76-07	South Dakota	IN00035
Iowa	098	Tennessee	TN02973
Kansas*	E-10233	Texas*	T104704187-15-8
Kentucky	90056	Texas/TCEQ	TX207
Louisiana*	LA170006	Utah*	IN00035
Maine	IN00035	Vermont	VT-8775
Maryland	209	Virginia*	460275
Massachusetts	M-IN035	Washington	C837
Michigan	9926	West Virginia	9927 C
Minnesota*	018-999-338	Wisconsin	999766900
Mississippi	IN035	Wyoming	IN035
EPA	IN00035		

*NELAP/TNI Recognized Accreditation Bodies

Revision date: 08/28/2017

eurofins | Eaton Analytical

110 South Hill Street
South Bend, IN 46617
Tel: (574) 233-4777
Fax: (574) 233-8207
1 800 332 4345

Laboratory Report

Client: Alpha Analytical

Attn: Ethan Leighton
35 Whitney Road
Suite 5
Mahwah, NJ 07430

Report: 398081
Priority: Standard Written
Status: Final
PWS ID: Not Supplied

Sample Information

EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3778988	L1732361-1/Raw-11	317.0	09/13/17 10:00	Client	09/15/17 09:30
3778989	L1732361-2/Trojan-11	317.0	09/13/17 10:00	Client	09/15/17 09:30
3778990	L1732361-3/Filter E-11	317.0	09/13/17 10:00	Client	09/15/17 09:30
3778991	L1732361-4/Filter F-11	317.0	09/13/17 10:00	Client	09/15/17 09:30

Report Summary

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call James Van Fleit at (574) 233-4777.

Note: This report may not be reproduced, except in full, without written approval from EEA.

Jim Van Fleit ASM

09/26/2017

Authorized Signature | Title | Date

Client Name: Alpha Analytical
Report #: 398081

Client Name: Alpha Analytical

Report #: 398081

Sampling Point: L1732361-1/Raw-11

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	09/21/17 23:40	3778988

Sampling Point: L1732361-2/Trojan-11

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	09/22/17 00:05	3778989

Sampling Point: L1732361-3/Filter E-11

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	09/22/17 00:30	3778990

Sampling Point: L1732361-4/Filter F-11

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	Analyte	Method	Reg Limit	MRL†	Result	Units	Preparation Date	Analyzed Date	EEA ID #
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	09/22/17 00:55	3778991

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!

Client Name: Alpha Analytical Report #: 398081

Lab Definitions

Continuing Calibration Check Standard (CCC) / Continuing Calibration Verification (CCV) / Initial Calibration Verification Standard (ICV) / Initial Performance Check (IPC) - is a standard containing one or more of the target analytes that is prepared from the same standards used to calibrate the instrument. This standard is used to verify the calibration curve at the beginning of each analytical sequence, and may also be analyzed throughout and at the end of the sequence. The concentration of continuing standards may be varied, when prescribed by the reference method, so that the range of the calibration curve is verified on a regular basis. CCL, CCM, and CCH are the CCC standards at low, mid, and high concentration levels, respectively.

Internal Standards (IS) - are pure compounds with properties similar to the analytes of interest, which are added to field samples or extracts, calibration standards, and quality control standards at a known concentration. They are used to measure the relative responses of the analytes of interest and surrogates in the sample, calibration standard or quality control standard.

Laboratory Duplicate (LD) - is a field sample aliquot taken from the same sample container in the laboratory and analyzed separately using identical procedures. Analysis of laboratory duplicates provides a measure of the precision of the laboratory procedures.

Laboratory Fortified Blank (LFB) / Laboratory Control Sample (LCS) - is an aliquot of reagent water to which known concentrations of the analytes of interest are added. The LFB is analyzed exactly the same as the field samples. LFBs are used to determine whether the method is in control. FBL, FBM, and FBH are the LFB samples at low, mid, and high concentration levels, respectively.

Laboratory Method Blank (LMB) / Laboratory Reagent Blank (LRB) - is a sample of reagent water included in the sample batch analyzed in the same way as the associated field samples. The LMB is used to determine if method analytes or other background contamination have been introduced during the preparation or analytical procedure. The LMB is analyzed exactly the same as the field samples.

Laboratory Trip Blank (LTB) / Field Reagent Blank (FRB) - is a sample of laboratory reagent water placed in a sample container in the laboratory and treated as a field sample, including storage, preservation, and all analytical procedures. The FRB/LTB container follows the collection bottles to and from the collection site, but the FRB/LTB is not opened at any time during the trip. The FRB/LTB is primarily a travel blank used to verify that the samples were not contaminated during shipment.

Matrix Spike Duplicate Sample (MSD) / Laboratory Fortified Sample Matrix Duplicate (LFSMD) - is a sample aliquot taken from the same field sample source as the Matrix Spike Sample to which known quantities of the analytes of interest are added in the laboratory. The MSD is analyzed exactly the same as the field samples. Analysis of the MSD provides a measure of the precision of the laboratory procedures in a specific matrix. SDL, SDM, and SDH / LFSMDL, LFSMDM, and LFSMDH are the MSD or LFSMD at low, mid, and high concentration levels, respectively.

Matrix Spike Sample (MS) / Laboratory Fortified Sample Matrix (LFSM) - is a sample aliquot taken from field sample source to which known quantities of the analytes of interest are added in the laboratory. The MS is analyzed exactly the same as the field samples. The purpose is to demonstrate recovery of the analytes from a sample matrix to determine if the specific matrix contributes bias to the analytical results. MSL, MSM, and MSH / LFSML, LFSMM, and LFSMH are the MS or LFSM at low, mid, and high concentration levels, respectively.

Quality Control Standard (QCS) / Second Source Calibration Verification (SSCV) - is a solution containing known concentrations of the analytes of interest prepared from a source different from the source of the calibration standards. The solution is obtained from a second manufacturer or lot if the lot can be demonstrated by the manufacturer as prepared independently from other lots. The QCS sample is analyzed using the same procedures as field samples. The QCS is used as a check on the calibration standards used in the method on a routine basis.

Reporting Limit Check (RLC) / Initial Calibration Check Standard (ICCS) - is a procedural standard that is analyzed each day to evaluate instrument performance at or below the minimum reporting limit (MRL).

Surrogate Standard (SS) / Surrogate Analyte (SUR) - is a pure compound with properties similar to the analytes of interest, which is highly unlikely to be found in any field sample, that is added to the field samples, calibration standards, blanks and quality control standards before sample preparation. The SS is used to evaluate the efficiency of the sample preparation process.

SUB UPS: Eurofins, IN

3 98081 326 719

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193
Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #: L1732361

Project Information

Project Name:

Project Location: MA

Project #:

Project Manager: Ethan Leighton

ALPHA Quote #:

Report Information — ☐ FAX ☐ EMAIL ☐ ADEx ☐ Add'l Deliverables

Data Deliverables

Billing Information — ☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program | Criteria

Client Information

Client: Alpha Analytical Lab
Address: 8 Walkup Drive
Westborough, Ma 01581
Phone: 508-898-9220
Fax:
Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Turn-Around Time

☐ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☐ No Are MCP Analytical Methods Required?
☐ Yes ☐ No Are CT RCP (Reasonable Confidence Protocols) Required?

Other Project Specific Requirements/Comments/Detection Limits:
Please reference Alpha Job #L1732361 on this report.

ANALYSIS

SAMPLE HANDLING
Filtration
☐ Done ☐ Not Needed ☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Bromate	Sample Specific Comments	TOTAL # BOTTLES
3778988	RAW-11 L1732361-1	9/13/17	10:00	DW		X		1
989	TROJAN-11 -2	9/13/17	10:00	DW		X		1
990	FILTER E-11 -3	9/13/17	10:00	DW		X		1
991	FILTER F-11 -4	9/13/17	10:00	DW		X		1
	West							

Container Type	P		-	-	-	-	-	-	-	-	-	-	
Preservative	O		-	-	-	-	-	-	-	-	-	-	

Serial_No:10031711:57

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time
	9/14/17	KDW	9-15-17 0930

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

FORM NO: 01-01(I) (rev. 30-JUL-07)

ANALYTICAL REPORT

Lab Number:	L1733478
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Erik Grotton
Phone:	(508) 248-7094
Project Name:	MAHER WELL PILOT
Project Number:	20107
Report Date:	10/09/17

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1733478
Report Date: 10/09/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1733478-01	RAW-12	DW	BARNSTABLE, MA	09/20/17 09:00	09/20/17
L1733478-02	TROJAN-12	DW	BARNSTABLE, MA	09/20/17 09:00	09/20/17
L1733478-03	FILTER E-12	DW	BARNSTABLE, MA	09/20/17 09:00	09/20/17
L1733478-04	FILTER F-12	DW	BARNSTABLE, MA	09/20/17 09:00	09/20/17
L1733478-05	FIELD BLANK	DW	BARNSTABLE, MA	09/20/17 09:00	09/20/17

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1733478
Project Number:	20107	**Report Date:**	10/09/17

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. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated 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.

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 table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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 Client Service Representative 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 Client Services at 800-624-9220 with any questions.

Project Name: MAHER WELL PILOT **Lab Number:** L1733478
Project Number: 20107 **Report Date:** 10/09/17

Case Narrative (continued)

Report Submission

The analysis of Bromate was subcontracted. A copy of the laboratory report is included as an addendum. Please note: This data is only available in PDF format and is not available on Data Merger.

Sample Receipt

The samples were received via Client in coolers with ice; however, the ice was melted in one cooler and that sample was above the required temperature range. Per client authorization of the exceedance, all requested analyses were performed.

L1733478-01 through -04: The samples were received above the appropriate pH for the 1,4-Dioxane analysis.

Perfluorinated Alkyl Acids

L1733478-03 and -05: The surrogate recovery was outside the acceptance criteria for n-deuterioethylperfluoro-1-octanesulfonamidoacetic acid (d5-netfosaa) (138% and 157%, respectively); however, re-analysis achieved similar results. The results of the original analysis are reported.

The surrogate recovery for the WG1044670-3 LCSD, associated with L1733478-01, -03, -04, and -05, is below the acceptance criteria for n-deuterioethylperfluoro-1-octanesulfonamidoacetic acid (d5-netfosaa) (63%). The associated LCS spike compounds are within overall acceptance criteria, therefore, no further action was taken.

Turbidity

The WG1043901-3 Laboratory Duplicate RPD (14%), performed on L1733478-01, is above the acceptance criteria; however, the sample and duplicate results are less than five times the reporting limit. Therefore, the RPD is valid.

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: Kara Lindquist

Title: Technical Director/Representative Date: 10/09/17

ORGANICS

SEMIVOLATILES

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1733478
Report Date: 10/09/17

SAMPLE RESULTS

Lab ID: L1733478-01
Client ID: RAW-12
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 09/22/17 18:07
Analyst: TJ

Date Collected: 09/20/17 09:00
Date Received: 09/20/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 09/22/17 05:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.412		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	87		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1733478
Report Date: 10/09/17

SAMPLE RESULTS

Lab ID: L1733478-01
Client ID: RAW-12
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/26/17 20:53
Analyst: AJ

Date Collected: 09/20/17 09:00
Date Received: 09/20/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 09/22/17 14:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	18.3		ng/l	1.67	--	1
Perfluorooctanesulfonic Acid (PFOS)	67.6		ng/l	1.67	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	94		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	102		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	79		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1733478
Report Date: 10/09/17

SAMPLE RESULTS

Lab ID: L1733478-02
Client ID: TROJAN-12
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 09/22/17 18:32
Analyst: TJ

Date Collected: 09/20/17 09:00
Date Received: 09/20/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 09/22/17 05:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	89		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1733478
Report Date: 10/09/17

SAMPLE RESULTS

Lab ID: L1733478-03
Client ID: FILTER E-12
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 09/22/17 18:57
Analyst: TJ

Date Collected: 09/20/17 09:00
Date Received: 09/20/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 09/22/17 05:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.144	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	86		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1733478
Report Date: 10/09/17

SAMPLE RESULTS

Lab ID: L1733478-03
Client ID: FILTER E-12
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/26/17 21:08
Analyst: AJ

Date Collected: 09/20/17 09:00
Date Received: 09/20/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 09/22/17 14:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	99		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	109		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	**138**	Q	70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1733478
Report Date: 10/09/17

SAMPLE RESULTS

Lab ID: L1733478-04
Client ID: FILTER F-12
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 09/22/17 19:22
Analyst: TJ

Date Collected: 09/20/17 09:00
Date Received: 09/20/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 09/22/17 05:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.144	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	87		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1733478
Report Date: 10/09/17

SAMPLE RESULTS

Lab ID: L1733478-04
Client ID: FILTER F-12
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/26/17 21:23
Analyst: AJ

Date Collected: 09/20/17 09:00
Date Received: 09/20/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 09/22/17 14:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	101		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	114		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	125		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1733478
Report Date: 10/09/17

SAMPLE RESULTS

Lab ID: L1733478-05
Client ID: FIELD BLANK
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 09/26/17 21:38
Analyst: AJ

Date Collected: 09/20/17 09:00
Date Received: 09/20/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 09/22/17 14:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.92	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.92	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	105		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	120		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	**157**	Q	70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1733478
Report Date: 10/09/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 120,522
Analytical Date: 09/22/17 06:26
Analyst: TJ

Extraction Method: EPA 522
Extraction Date: 09/22/17 05:00

Parameter	Result	Qualifier	Units	RL	MDL
1,4 Dioxane by EPA 522 - Mansfield Lab for sample(s): 01-04 Batch: WG1044549-1					
1,4-Dioxane	ND		ug/l	0.150	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	87		70-130

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1733478
Report Date: 10/09/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 122,537
Analytical Date: 09/26/17 17:52
Analyst: AJ

Extraction Method: EPA 537
Extraction Date: 09/22/17 14:00

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab for sample(s): 01,03-05 Batch: WG1044670-1					
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	102		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	108		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	83		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1733478

Report Date: 10/09/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-04 Batch: WG1044549-2 WG1044549-3								
1,4-Dioxane	88		91		70-130	3		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,4-Dioxane-d8	89		86		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1733478

Report Date: 10/09/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01,03-05 Batch: WG1044670-2 WG1044670-3								
Perfluorooctanoic Acid (PFOA)	110		111		70-130	1		30
Perfluorooctanesulfonic Acid (PFOS)	108		112		70-130	4		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	98		95		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	97		106		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	95		**63**	Q	70-130

METALS

Project Name: MAHER WELL PILOT
Lab Number: L1733478
Project Number: 20107
Report Date: 10/09/17

SAMPLE RESULTS

Lab ID: L1733478-01
Client ID: RAW-12
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 09/20/17 09:00
Date Received: 09/20/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.069		mg/l	0.050	--	1	09/27/17 10:30	09/28/17 12:47	EPA 3005A	19,200.7	PS
Manganese, Total	0.053		mg/l	0.010	--	1	09/27/17 10:30	09/28/17 12:47	EPA 3005A	19,200.7	PS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1733478
Report Date: 10/09/17

SAMPLE RESULTS

Lab ID: L1733478-02
Client ID: TROJAN-12
Sample Location: BARNSTABLE, MA
Matrix: Dw
Date Collected: 09/20/17 09:00
Date Received: 09/20/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.090		mg/l	0.050	--	1	09/27/17 10:30	09/28/17 18:14	EPA 3005A	19,200.7	AB
Manganese, Total	0.050		mg/l	0.010	--	1	09/27/17 10:30	09/28/17 18:14	EPA 3005A	19,200.7	AB

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1733478
Report Date: 10/09/17

SAMPLE RESULTS

Lab ID: L1733478-03
Client ID: FILTER E-12
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 09/20/17 09:00
Date Received: 09/20/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	09/27/17 10:30	09/28/17 18:19	EPA 3005A	19,200.7	AB
Manganese, Total	0.045		mg/l	0.010	--	1	09/27/17 10:30	09/28/17 18:19	EPA 3005A	19,200.7	AB

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1733478
Report Date: 10/09/17

SAMPLE RESULTS

Lab ID: L1733478-04
Client ID: FILTER F-12
Sample Location: BARNSTABLE, MA
Matrix: Dw
Date Collected: 09/20/17 09:00
Date Received: 09/20/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	09/27/17 10:30	09/28/17 18:24	EPA 3005A	19,200.7	AB
Manganese, Total	0.046		mg/l	0.010	--	1	09/27/17 10:30	09/28/17 18:24	EPA 3005A	19,200.7	AB

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1733478
Report Date: 10/09/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-04 Batch: WG1045862-1										
Iron, Total	ND		mg/l	0.050	--	1	09/27/17 10:30	09/28/17 12:37	19,200.7	PS
Manganese, Total	ND		mg/l	0.010	--	1	09/27/17 10:30	09/28/17 12:37	19,200.7	PS

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1733478

Report Date: 10/09/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 Batch: WG1045862-2								
Iron, Total	106		-		85-115	-		
Manganese, Total	101		-		85-115	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1733478
Report Date: 10/09/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1045862-3 QC Sample: L1733478-01 Client ID: RAW-12												
Iron, Total	0.069	1	1.09	102		-	-		75-125	-		20
Manganese, Total	0.053	0.5	0.540	97		-	-		75-125	-		20
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1045862-7 QC Sample: L1733492-01 Client ID: MS Sample												
Iron, Total	ND	1	1.09	109		-	-		75-125	-		20
Manganese, Total	ND	0.5	0.505	101		-	-		75-125	-		20

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1733478
Report Date: 10/09/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1045862-4 QC Sample: L1733478-01 Client ID: RAW-12						
Iron, Total	0.069	0.066	mg/l	4		20
Manganese, Total	0.053	0.054	mg/l	1		20

INORGANICS
&
MISCELLANEOUS

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1733478
Report Date: 10/09/17

SAMPLE RESULTS

Lab ID: L1733478-01
Client ID: RAW-12
Sample Location: BARNSTABLE, MA
Matrix: Dw

Date Collected: 09/20/17 09:00
Date Received: 09/20/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.20		NTU	0.20	--	1	-	09/20/17 22:30	44,180.1	CW
Alkalinity, Total	13.5		mg CaCO3/L	2.00	NA	1	-	09/21/17 09:12	121,2320B	BR
pH (H)	6.2		SU	-	NA	1	-	09/20/17 21:20	121,4500H+-B	CW

Project Name: MAHER WELL PILOT
Project Number: 20107
Lab Number: L1733478
Report Date: 10/09/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1043901-1										
Turbidity	ND		NTU	0.20	--	1	-	09/20/17 22:30	44,180.1	CW
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1044033-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	09/21/17 09:12	121,2320B	BR

Lab Control Sample Analysis

Batch Quality Control

Project Name: MAHER WELL PILOT

Project Number: 20107

Lab Number: L1733478

Report Date: 10/09/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1043899-1								
pH	100		-		99-101	-		5
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1043901-2								
Turbidity	97		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1044033-2								
Alkalinity, Total	104		-		90-110	-		10

Matrix Spike Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1733478
Report Date: 10/09/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1044033-4 QC Sample: L1733478-01 Client ID: RAW-12												
Alkalinity, Total	13.5	100	113	100		-	-		86-116	-		10

Lab Duplicate Analysis
Batch Quality Control

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1733478
Report Date: 10/09/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1043899-2 QC Sample: L1733428-01 Client ID: DUP Sample						
pH	7.5	7.5	SU	0		5
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1043901-3 QC Sample: L1733478-01 Client ID: RAW-12						
Turbidity	0.20	0.23	NTU	**14**	Q	13
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1044033-3 QC Sample: L1733478-01 Client ID: RAW-12						
Alkalinity, Total	13.5	13.3	mg CaCO3/L	1		10

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1733478
Report Date: 10/09/17

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent
B	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1733478-01A	Plastic 250ml HNO3 preserved	B	<2	<2	4.6	Y	Absent		FE-UI(180),MN-UI(180)
L1733478-01B	Plastic 250ml unpreserved	B	7	7	4.6	Y	Absent		TURB-180(2),PH-4500(.01)
L1733478-01C	Plastic 250ml unpreserved/No Headspace	B	NA		4.6	Y	Absent		ALK-T-2320(14)
L1733478-01D	Plastic 250ml Trizma preserved	B	NA		4.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1733478-01E	Plastic 250ml Trizma preserved	B	NA		4.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1733478-01F	Plastic 250ml Trizma preserved	B	NA		4.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1733478-01G	Amber 500ml NaSulfite/NaHSO4 preserved	B	6	6	4.6	N	Absent		A2-14DIOXANE-522(28)
L1733478-01H	Amber 500ml NaSulfite/NaHSO4 preserved	B	6	6	4.6	N	Absent		A2-14DIOXANE-522(28)
L1733478-02A	Plastic 250ml HNO3 preserved	B	<2	<2	4.6	Y	Absent		FE-UI(180),MN-UI(180)
L1733478-02B	Plastic 120ml Other preserved (sub-lab)	B	7	7	4.6	Y	Absent		SUB-BROMATE()
L1733478-02G	Amber 500ml NaSulfite/NaHSO4 preserved	B	6	6	4.6	N	Absent		A2-14DIOXANE-522(28)
L1733478-02H	Amber 500ml NaSulfite/NaHSO4 preserved	B	6	6	4.6	N	Absent		A2-14DIOXANE-522(28)
L1733478-03A	Plastic 250ml HNO3 preserved	B	<2	<2	4.6	Y	Absent		FE-UI(180),MN-UI(180)
L1733478-03D	Plastic 250ml Trizma preserved	B	NA		4.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1733478-03E	Plastic 250ml Trizma preserved	B	NA		4.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1733478-03F	Plastic 250ml Trizma preserved	B	NA		4.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1733478-03G	Amber 500ml NaSulfite/NaHSO4 preserved	B	6	6	4.6	N	Absent		A2-14DIOXANE-522(28)
L1733478-03H	Amber 500ml NaSulfite/NaHSO4 preserved	B	6	6	4.6	N	Absent		A2-14DIOXANE-522(28)
L1733478-04A	Plastic 250ml HNO3 preserved	B	<2	<2	4.6	Y	Absent		FE-UI(180),MN-UI(180)
L1733478-04D	Plastic 250ml Trizma preserved	B	NA		4.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1733478-04E	Plastic 250ml Trizma preserved	B	NA		4.6	Y	Absent		A2-537-PFOA/PFOS(14)
L1733478-04F	Plastic 250ml Trizma preserved	B	NA		4.6	Y	Absent		A2-537-PFOA/PFOS(14)

*Values in parentheses indicate holding time in days

Project Name: MAHER WELL PILOT
Project Number: 20107

Lab Number: L1733478
Report Date: 10/09/17

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1733478-04G	Amber 500ml NaSulfite/NaHSO4 preserved	B	6	6	4.6	N	Absent		A2-14DIOXANE-522(28)
L1733478-04H	Amber 500ml NaSulfite/NaHSO4 preserved	B	6	6	4.6	N	Absent		A2-14DIOXANE-522(28)
L1733478-05D	Plastic 250ml Trizma preserved	A	NA		8.3	Y	Absent		A2-537-PFOA/PFOS(14)

*Values in parentheses indicate holding time in days

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1733478
Project Number:	20107	**Report Date:**	10/09/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1733478
Project Number:	20107	**Report Date:**	10/09/17

Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name:	MAHER WELL PILOT	**Lab Number:**	L1733478
Project Number:	20107	**Report Date:**	10/09/17

REFERENCES

19 Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

120 Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography/Mass Spectrometry (GC/MS) with Selected Ion Monitoring (SIM). EPA Method 522, EPA/600/R-08/101. Version 1.0, September 2008.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

122 Determination of Selected Perfluorintated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). EPA Method 537, EPA/600/R-08/092. Version 1.1, September 2009.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL
World Class Chemistry
8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220
320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

Date Rec'd in Lab: 9/20/17

ALPHA Job #: L1733478

Client Information

Client: Bluelect, Inc.
Address: 57 Dresser Hill Rd.
Charlton MA 01507
Phone: 774 200 9029
Email: egrotton@bluelectwater.com

Additional Project Information:

Project Information

Project Name: Maher Well Pilot
Project Location: Barnstable, MA
Project #: 2017
Project Manager: Erik Grotton
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved)
Date Due:

Report Information - Data Deliverables

☐ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	ANALYSIS: VOC: ☐ 8260 ☐ 624 ☐ 524.2	SVOC: ☐ ABN ☐ PAH	METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15	METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13	EPH: ☐ Ranges & Targets ☐ Ranges Only	VPH: ☐ Ranges & Targets ☐ Ranges Only	☐ PCB ☐ PEST	TPH: ☐ Quant Only ☐ Fingerprint	Total Fe + Mn	1,4 Dioxane	PFAS / PFOA	Bromate	Sample Comments	TOTAL # BOTTLES
33478-01	Raw-12	9/20	9:00	DW	ARD									X	X	X	X		8
02	Trip-12	↓	↓	↓	↓									X		X	X		4
03	Filter E-12													X		X	X		6
04	Filter F-12													X		X	X		6
05	Field Blank																X		1

SAMPLE INFO
Filtration
☐ Field
☐ Lab to do
Preservation
☐ Lab to do

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H= $Na_2S_2O_3$
I= Ascorbic Acid
J= NH_4Cl
K= Zn Acetate
O= Other

	Container Type	Preservative

Relinquished By:	Date/Time	Received By:	Date/Time
	9/20/17 13:22	ARD	9/20/17 1322

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

SUB UPS: Eurofins, IN (WM)

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193
Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #: L1733478

Client Information

Client: Alpha Analytical Lab
Address: 8 Walkup Drive
Westborough, Ma 01581
Phone: 508-898-9220
Fax:
Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Project Information

Project Name:
Project Location: MA
Project #:
Project Manager: Ethan Leighton
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

Report Information Data Deliverables

☐ FAX ☐ EMAIL
☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program | Criteria

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☐ No Are MCP Analytical Methods Required?
☐ Yes ☐ No Are CT RCP (Reasonable Confidence Protocols) Required?

Other Project Specific Requirements/Comments/Detection Limits:
Please reference Alpha Job #L1733478 on this report.

ANALYSIS

SAMPLE HANDLING
Filtration
☐ Done
☐ Not Needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Bromate	Sample Specific Comments	TOTAL # BOTTLES
	TROJAN-12	9/20/17	09:00	DW		X		1

Container Type	P		-	-	-	-	-	-	-	-	-	-
Preservative	O		-	-	-	-	-	-	-	-	-	-

PLEASE ANSWER QUESTIONS ABOVE!

S YOUR PROJECT MA MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

FORM NO: 01-01(I)
rev. 30-JUL-07)

eurofins | Eaton Analytical

LABORATORY REPORT

If you have any questions concerning this report, please do not hesitate to call us at (800) 332-4345 or (574) 233-4777.

eurofins | Eaton Analytical

STATE CERTIFICATION LIST

State	Certification	State	Certification
Alabama	40700	Missouri	880
Alaska	IN00035	Montana	CERT0026
Arizona	AZ0432	Nebraska	NE-OS-05-04
Arkansas	IN00035	Nevada	IN00035
California	2920	New Hampshire*	2124
Colorado	IN035	New Jersey*	IN598
Colorado Radiochemistry	IN035	New Mexico	IN00035
Connecticut	PH-0132	New York*	11398
Delaware	IN035	North Carolina	18700
Florida*	E87775	North Dakota	R-035
Georgia	929	Ohio	87775
Hawaii	IN035	Oklahoma	D9508
Idaho	IN00035	Oregon (Primary AB)*	4074-001
Illinois*	200001	Pennsylvania*	68-00466
Illinois Microbiology	17767	Puerto Rico	IN00035
Illinois Radiochemistry	IN00035	Rhode Island	LAO00343
Indiana Chemistry	C-71-01	South Carolina	95005
Indiana Microbiology	M-76-07	South Dakota	IN00035
Iowa	098	Tennessee	TN02973
Kansas*	E-10233	Texas*	T104704187-15-8
Kentucky	90056	Texas/TCEQ	TX207
Louisiana*	LA170006	Utah*	IN00035
Maine	IN00035	Vermont	VT-8775
Maryland	209	Virginia*	460275
Massachusetts	M-IN035	Washington	C837
Michigan	9926	West Virginia	9927 C
Minnesota*	018-999-338	Wisconsin	999766900
Mississippi	IN035	Wyoming	IN035
EPA	IN00035		

*NELAP/TNI Recognized Accreditation Bodies

Revision date: 08/28/2017

eurofins | Eaton Analytical

110 South Hill Street
South Bend, IN 46617
Tel: (574) 233-4777
Fax: (574) 233-8207
1 800 332 4345

Laboratory Report

Client: Alpha Analytical

Attn: Ethan Leighton
35 Whitney Road
Suite 5
Mahwah, NJ 07430

Report: 398717
Priority: Standard Written
Status: Final
PWS ID: Not Supplied

Sample Information

EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3784545	L1733478/Trojan-12	317.0	09/20/17 09:00	Client	09/22/17 10:00

Report Summary

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call James Van Fleit at (574) 233-4777.

Note: This report may not be reproduced, except in full, without written approval from EEA.

Jim Van Fleit ASM

Authorized Signature | Title

10/06/2017

Date

Client Name: Alpha Analytical
Report #: 398717

Client Name: Alpha Analytical

Report #: 398717

Sampling Point: L1733478/Trojan-12

PWS ID: Not Supplied

General Chemistry									
Analyte ID #	**Analyte**	**Method**	**Reg Limit**	**MRL†**	**Result**	**Units**	**Preparation Date**	**Analyzed Date**	**EEA ID #**
15541-45-4	Bromate	317.0	10 *	1.0	< 1.0	ug/L	---	10/03/17 13:38	3784545

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!

Client Name: Alpha Analytical Report #: 398717

Lab Definitions

Continuing Calibration Check Standard (CCC) / Continuing Calibration Verification (CCV) / Initial Calibration Verification Standard (ICV) / Initial Performance Check (IPC) - is a standard containing one or more of the target analytes that is prepared from the same standards used to calibrate the instrument. This standard is used to verify the calibration curve at the beginning of each analytical sequence, and may also be analyzed throughout and at the end of the sequence. The concentration of continuing standards may be varied, when prescribed by the reference method, so that the range of the calibration curve is verified on a regular basis. CCL, CCM, and CCH are the CCC standards at low, mid, and high concentration levels, respectively.

Internal Standards (IS) - are pure compounds with properties similar to the analytes of interest, which are added to field samples or extracts, calibration standards, and quality control standards at a known concentration. They are used to measure the relative responses of the analytes of interest and surrogates in the sample, calibration standard or quality control standard.

Laboratory Duplicate (LD) - is a field sample aliquot taken from the same sample container in the laboratory and analyzed separately using identical procedures. Analysis of laboratory duplicates provides a measure of the precision of the laboratory procedures.

Laboratory Fortified Blank (LFB) / Laboratory Control Sample (LCS) - is an aliquot of reagent water to which known concentrations of the analytes of interest are added. The LFB is analyzed exactly the same as the field samples. LFBs are used to determine whether the method is in control. FBL, FBM, and FBH are the LFB samples at low, mid, and high concentration levels, respectively.

Laboratory Method Blank (LMB) / Laboratory Reagent Blank (LRB) - is a sample of reagent water included in the sample batch analyzed in the same way as the associated field samples. The LMB is used to determine if method analytes or other background contamination have been introduced during the preparation or analytical procedure. The LMB is analyzed exactly the same as the field samples.

Laboratory Trip Blank (LTB) / Field Reagent Blank (FRB) - is a sample of laboratory reagent water placed in a sample container in the laboratory and treated as a field sample, including storage, preservation, and all analytical procedures. The FRB/LTB container follows the collection bottles to and from the collection site, but the FRB/LTB is not opened at any time during the trip. The FRB/LTB is primarily a travel blank used to verify that the samples were not contaminated during shipment.

Matrix Spike Duplicate Sample (MSD) / Laboratory Fortified Sample Matrix Duplicate (LFSMD) - is a sample aliquot taken from the same field sample source as the Matrix Spike Sample to which known quantities of the analytes of interest are added in the laboratory. The MSD is analyzed exactly the same as the field samples. Analysis of the MSD provides a measure of the precision of the laboratory procedures in a specific matrix. SDL, SDM, and SDH / LFSMDL, LFSMDM, and LFSMDH are the MSD or LFSMD at low, mid, and high concentration levels, respectively.

Matrix Spike Sample (MS) / Laboratory Fortified Sample Matrix (LFSM) - is a sample aliquot taken from field sample source to which known quantities of the analytes of interest are added in the laboratory. The MS is analyzed exactly the same as the field samples. The purpose is to demonstrate recovery of the analytes from a sample matrix to determine if the specific matrix contributes bias to the analytical results. MSL, MSM, and MSH / LFSML, LFSMM, and LFSMH are the MS or LFSM at low, mid, and high concentration levels, respectively.

Quality Control Standard (QCS) / Second Source Calibration Verification (SSCV) - is a solution containing known concentrations of the analytes of interest prepared from a source different from the source of the calibration standards. The solution is obtained from a second manufacturer or lot if the lot can be demonstrated by the manufacturer as prepared independently from other lots. The QCS sample is analyzed using the same procedures as field samples. The QCS is used as a check on the calibration standards used in the method on a routine basis.

Reporting Limit Check (RLC) / Initial Calibration Check Standard (ICCS) - is a procedural standard that is analyzed each day to evaluate instrument performance at or below the minimum reporting limit (MRL).

Surrogate Standard (SS) / Surrogate Analyte (SUR) - is a pure compound with properties similar to the analytes of interest, which is highly unlikely to be found in any field sample, that is added to the field samples, calibration standards, blanks and quality control standards before sample preparation. The SS is used to evaluate the efficiency of the sample preparation process.

SUB UPS: Eurofins, IN (WM)

327136

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193

Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #: L1733478 398717

Client Information

Client: Alpha Analytical Lab

Address: 8 Walkup Drive

Westborough, Ma 01581

Phone: 508-898-9220

Fax:

Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Project Information

Project Name:

Project Location: MA

Project #:

Project Manager: Ethan Leighton

ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

Report Information — Data Deliverables

☐ FAX ☐ EMAIL

☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program Criteria

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☐ No Are MCP Analytical Methods Required?

☐ Yes ☐ No Are CT RCP (Reasonable Confidence Protocols) Required?

Other Project Specific Requirements/Comments/Detection Limits:

Please reference Alpha Job #L1733478 on this report.

Wet ice

ANALYSIS

SAMPLE HANDLING

Filtration

☐ Done

☐ Not Needed

☐ Lab to do

Preservation

☐ Lab to do

(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Bromate	Sample Specific Comments	TOTAL # BOTTLES
3784 545	TROJAN-12	9/20/17	09:00	DW		X		1

Container Type	P		-	-	-	-	-	-	-	-	-	-
Preservative	O		-	-	-	-	-	-	-	-	-	-

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	9/21/17	KRun	9-22-17 1000

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

FORM NO: 01-01(I) (rev. 31-JUL-07)

ANALYTICAL REPORT

Lab Number:	L1734538
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Erik Grotton
Phone:	(508) 248-7094
Project Name:	Not Specified
Project Number:	20107
Report Date:	10/11/17

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1734538-01	RAW-13	DW	Not Specified	09/27/17 10:00	09/27/17
L1734538-02	TROJAN-13	DW	Not Specified	09/27/17 10:00	09/27/17
L1734538-03	FILTER E-13	DW	Not Specified	09/27/17 10:00	09/27/17
L1734538-04	FILTER F-13	DW	Not Specified	09/27/17 10:00	09/27/17
L1734538-05	FIELD BLANK	DW	Not Specified	09/27/17 10:00	09/27/17

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

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. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated 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.

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 table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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 Client Service Representative 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 Client Services at 800-624-9220 with any questions.

Project Name: Not Specified
Project Number: 20107
Lab Number: L1734538
Report Date: 10/11/17

Case Narrative (continued)

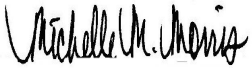
Sample Receipt

L1734538-01, -03 and -04: The sample was received above the appropriate pH for 1,4 Dioxane by EPA 522 analysis.

Perfluorinated Alkyl Acids

L1734538-01: The surrogate recovery was below the acceptance criteria for n-deuterioethylperfluoro-1-octanesulfonamidoacetic acid (d5-netfosaa) (69%); however, the sample was extracted as the WG1047952-4 batch duplicate with all criteria met. The results of both analyses are reported.

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:  Michelle M. Morris

Title: Technical Director/Representative Date: 10/11/17

ORGANICS

SEMIVOLATILES

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

SAMPLE RESULTS

Lab ID: L1734538-01
Client ID: RAW-13
Sample Location: Not Specified

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 10/02/17 19:31
Analyst: TJ

Date Collected: 09/27/17 10:00
Date Received: 09/27/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 10/02/17 09:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.403		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	84		70-130

Project Name: Not Specified
Project Number: 20107
Lab Number: L1734538
Report Date: 10/11/17

SAMPLE RESULTS

Lab ID: L1734538-01
Client ID: RAW-13
Sample Location: Not Specified

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 10/10/17 18:38
Analyst: AJ

Date Collected: 09/27/17 10:00
Date Received: 09/27/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 10/02/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	17.0		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	65.4		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	74		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	79		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	**69**	Q	70-130

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

SAMPLE RESULTS

Lab ID: L1734538-02
Client ID: TROJAN-13
Sample Location: Not Specified

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 10/02/17 19:53
Analyst: TJ

Date Collected: 09/27/17 10:00
Date Received: 09/27/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 10/02/17 09:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.144	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	83		70-130

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

SAMPLE RESULTS

Lab ID: L1734538-03
Client ID: FILTER E-13
Sample Location: Not Specified

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 10/02/17 20:15
Analyst: TJ

Date Collected: 09/27/17 10:00
Date Received: 09/27/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 10/02/17 09:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	83		70-130

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

SAMPLE RESULTS

Lab ID: L1734538-03
Client ID: FILTER E-13
Sample Location: Not Specified

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 10/10/17 19:08
Analyst: AJ

Date Collected: 09/27/17 10:00
Date Received: 09/27/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 10/02/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.78	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.78	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	81		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	82		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	83		70-130

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

SAMPLE RESULTS

Lab ID: L1734538-04
Client ID: FILTER F-13
Sample Location: Not Specified

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 10/02/17 20:38
Analyst: TJ

Date Collected: 09/27/17 10:00
Date Received: 09/27/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 10/02/17 09:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.144	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	86		70-130

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

SAMPLE RESULTS

Lab ID: L1734538-04
Client ID: FILTER F-13
Sample Location: Not Specified

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 10/10/17 19:38
Analyst: AJ

Date Collected: 09/27/17 10:00
Date Received: 09/27/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 10/02/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.72	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.72	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	81		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	84		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	86		70-130

Project Name: Not Specified
Project Number: 20107
Lab Number: L1734538
Report Date: 10/11/17

SAMPLE RESULTS

Lab ID: L1734538-05
Client ID: FIELD BLANK
Sample Location: Not Specified

Matrix: Dw
Analytical Method: 122,537
Analytical Date: 10/10/17 19:53
Analyst: AJ

Date Collected: 09/27/17 10:00
Date Received: 09/27/17
Field Prep: Not Specified
Extraction Method: EPA 537
Extraction Date: 10/02/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab						
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.85	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.85	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	85		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	89		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	99		70-130

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 120,522
Analytical Date: 10/02/17 10:22
Analyst: TJ

Extraction Method: EPA 522
Extraction Date: 10/02/17 09:00

Parameter	Result	Qualifier	Units	RL	MDL
1,4 Dioxane by EPA 522 - Mansfield Lab for sample(s): 01-04 Batch: WG1047881-1					
1,4-Dioxane	ND		ug/l	0.150	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	71		70-130

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 122,537
Analytical Date: 10/10/17 17:23
Analyst: AJ

Extraction Method: EPA 537
Extraction Date: 10/02/17 15:30

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab for sample(s): 01,03-05 Batch: WG1047952-1					
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	84		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	91		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	96		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: Not Specified

Project Number: 20107

Lab Number: L1734538

Report Date: 10/11/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-04 Batch: WG1047881-2 WG1047881-3								
1,4-Dioxane	85		87		70-130	2		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,4-Dioxane-d8	72		76		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: Not Specified

Project Number: 20107

Lab Number: L1734538

Report Date: 10/11/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01,03-05 Batch: WG1047952-2 WG1047952-3								
Perfluorooctanoic Acid (PFOA)	91		98		70-130	7		30
Perfluorooctanesulfonic Acid (PFOS)	96		112		70-130	15		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	78		80		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	88		87		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	90		88		70-130

Matrix Spike Analysis

Batch Quality Control

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

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 - Mansfield Lab Associated sample(s): 01,03-05 QC Batch ID: WG1047952-5 QC Sample: L1734538-03 Client ID: FILTER E-13												
Perfluorooctanoic Acid (PFOA)	ND	1.72	1.59J	92		-	-		70-130	-		30
Perfluorooctanesulfonic Acid (PFOS)	ND	1.6	1.15J	72		-	-		70-130	-		30

Surrogate	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	91				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	83				70-130
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	83				70-130

Lab Duplicate Analysis
Batch Quality Control

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537 - Mansfield Lab Associated sample(s): 01,03-05 QC Batch ID: WG1047952-4 QC Sample: L1734538-01 Client ID: RAW-13						
Perfluorooctanoic Acid (PFOA)	17.0	17.4	ng/l	2		30
Perfluorooctanesulfonic Acid (PFOS)	65.4	68.1	ng/l	4		30

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	74		82		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	79		84		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	**69**	Q	83		70-130

METALS

Project Name: Not Specified
Project Number: 20107
Lab Number: L1734538
Report Date: 10/11/17

SAMPLE RESULTS

Lab ID: L1734538-01
Client ID: RAW-13
Sample Location: Not Specified
Matrix: Dw
Date Collected: 09/27/17 10:00
Date Received: 09/27/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.065		mg/l	0.050	--	1	10/11/17 10:30	10/11/17 14:21	EPA 3005A	19,200.7	AB
Manganese, Total	0.051		mg/l	0.010	--	1	10/11/17 10:30	10/11/17 14:21	EPA 3005A	19,200.7	AB

Project Name: Not Specified
Project Number: 20107
Lab Number: L1734538
Report Date: 10/11/17

SAMPLE RESULTS

Lab ID: L1734538-02
Client ID: TROJAN-13
Sample Location: Not Specified
Matrix: Dw
Date Collected: 09/27/17 10:00
Date Received: 09/27/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.092		mg/l	0.050	--	1	10/11/17 10:30	10/11/17 14:45	EPA 3005A	19,200.7	AB
Manganese, Total	0.049		mg/l	0.010	--	1	10/11/17 10:30	10/11/17 14:45	EPA 3005A	19,200.7	AB

Project Name: Not Specified
Project Number: 20107
Lab Number: L1734538
Report Date: 10/11/17

SAMPLE RESULTS

Lab ID: L1734538-03
Client ID: FILTER E-13
Sample Location: Not Specified
Matrix: Dw
Date Collected: 09/27/17 10:00
Date Received: 09/27/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	10/11/17 10:30	10/11/17 14:50	EPA 3005A	19,200.7	AB
Manganese, Total	0.044		mg/l	0.010	--	1	10/11/17 10:30	10/11/17 14:50	EPA 3005A	19,200.7	AB

Project Name: Not Specified
Project Number: 20107
Lab Number: L1734538
Report Date: 10/11/17

SAMPLE RESULTS

Lab ID: L1734538-04
Client ID: FILTER F-13
Sample Location: Not Specified
Matrix: Dw
Date Collected: 09/27/17 10:00
Date Received: 09/27/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.050	--	1	10/11/17 10:30	10/11/17 14:54	EPA 3005A	19,200.7	AB
Manganese, Total	0.045		mg/l	0.010	--	1	10/11/17 10:30	10/11/17 14:54	EPA 3005A	19,200.7	AB

Project Name: Not Specified
Project Number: 20107
Lab Number: L1734538
Report Date: 10/11/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-04 Batch: WG1049200-1										
Iron, Total	ND		mg/l	0.050	--	1	10/11/17 10:30	10/11/17 14:12	19,200.7	AB
Manganese, Total	ND		mg/l	0.010	--	1	10/11/17 10:30	10/11/17 14:12	19,200.7	AB

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis

Batch Quality Control

Project Name: Not Specified

Project Number: 20107

Lab Number: L1734538

Report Date: 10/11/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 Batch: WG1049200-2								
Iron, Total	102		-		85-115	-		
Manganese, Total	98		-		85-115	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1049200-3 QC Sample: L1734538-01 Client ID: RAW-13												
Iron, Total	0.065	1	1.10	104		-	-		75-125	-		20
Manganese, Total	0.051	0.5	0.546	99		-	-		75-125	-		20

Lab Duplicate Analysis
Batch Quality Control

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1049200-4 QC Sample: L1734538-01 Client ID: RAW-13						
Iron, Total	0.065	0.063	mg/l	3		20
Manganese, Total	0.051	0.049	mg/l	4		20

INORGANICS
&
MISCELLANEOUS

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

SAMPLE RESULTS

Lab ID: L1734538-01
Client ID: RAW-13
Sample Location: Not Specified
Matrix: Dw

Date Collected: 09/27/17 10:00
Date Received: 09/27/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.31		NTU	0.20	--	1	-	09/27/17 18:32	44,180.1	AS
Alkalinity, Total	13.0		mg CaCO3/L	2.00	NA	1	-	09/28/17 09:25	121,2320B	BR
pH (H)	5.8		SU	-	NA	1	-	09/27/17 18:12	121,4500H+-B	AS

Project Name:

Project Number: 20107

Lab Number: L1734538

Report Date: 10/11/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1046336-1										
Turbidity	ND		NTU	0.20	--	1	-	09/27/17 18:32	44,180.1	AS
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1046547-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	09/28/17 09:25	121,2320B	BR

Lab Control Sample Analysis

Batch Quality Control

Project Name: Not Specified

Project Number: 20107

Lab Number: L1734538

Report Date: 10/11/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1046332-1								
pH	100		-		99-101	-		5
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1046336-2								
Turbidity	102		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1046547-2								
Alkalinity, Total	104		-		90-110	-		10

Matrix Spike Analysis
Batch Quality Control

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1046547-4 QC Sample: L1734538-01 Client ID: RAW-13												
Alkalinity, Total	13.0	100	112	99		-	-		86-116	-		10

Lab Duplicate Analysis
Batch Quality Control

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1046332-2 QC Sample: L1734538-01 Client ID: RAW-13						
pH (H)	5.8	5.8	SU	0		5
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1046336-3 QC Sample: L1734538-01 Client ID: RAW-13						
Turbidity	0.31	0.33	NTU	6		13
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1046547-3 QC Sample: L1734538-01 Client ID: RAW-13						
Alkalinity, Total	13.0	12.7	mg CaCO3/L	2		10

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

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(*)
L1734538-01A	Plastic 250ml HNO3 preserved	A	<2	<2	4.4	Y	Absent		FE-UI(180),MN-UI(180)
L1734538-01B	Plastic 250ml unpreserved	A	7	7	4.4	Y	Absent		TURB-180(2),PH-4500(.01)
L1734538-01C	Plastic 250ml unpreserved/No Headspace	A	NA		4.4	Y	Absent		ALK-T-2320(14)
L1734538-01D	Plastic 250ml Trizma preserved	A	NA		4.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1734538-01E	Plastic 250ml Trizma preserved	A	NA		4.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1734538-01F	Plastic 250ml Trizma preserved	A	NA		4.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1734538-01G	Amber 500ml NaSulfite/NaHSO4 preserved	A	6	6	4.4	N	Absent		A2-14DIOXANE-522(28)
L1734538-01H	Amber 500ml NaSulfite/NaHSO4 preserved	A	6	6	4.4	N	Absent		A2-14DIOXANE-522(28)
L1734538-02A	Plastic 250ml HNO3 preserved	A	<2	<2	4.4	Y	Absent		FE-UI(180),MN-UI(180)
L1734538-02G	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	4.4	Y	Absent		A2-14DIOXANE-522(28)
L1734538-02H	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	4.4	Y	Absent		A2-14DIOXANE-522(28)
L1734538-03A	Plastic 250ml HNO3 preserved	A	<2	<2	4.4	Y	Absent		FE-UI(180),MN-UI(180)
L1734538-03D	Plastic 250ml Trizma preserved	A	NA		4.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1734538-03E	Plastic 250ml Trizma preserved	A	NA		4.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1734538-03F	Plastic 250ml Trizma preserved	A	NA		4.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1734538-03G	Amber 500ml NaSulfite/NaHSO4 preserved	A	6	6	4.4	N	Absent		A2-14DIOXANE-522(28)
L1734538-03H	Amber 500ml NaSulfite/NaHSO4 preserved	A	6	6	4.4	N	Absent		A2-14DIOXANE-522(28)
L1734538-04A	Plastic 250ml HNO3 preserved	A	<2	<2	4.4	Y	Absent		FE-UI(180),MN-UI(180)
L1734538-04D	Plastic 250ml Trizma preserved	A	NA		4.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1734538-04E	Plastic 250ml Trizma preserved	A	NA		4.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1734538-04F	Plastic 250ml Trizma preserved	A	NA		4.4	Y	Absent		A2-537-PFOA/PFOS(14)
L1734538-04G	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	4.4	Y	Absent		A2-14DIOXANE-522(28)
L1734538-04H	Amber 500ml NaSulfite/NaHSO4 preserved	A	6	6	4.4	N	Absent		A2-14DIOXANE-522(28)

*Values in parentheses indicate holding time in days

Project Name: Not Specified
Project Number: 20107

Lab Number: L1734538
Report Date: 10/11/17

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1734538-05A	Plastic 250ml Trizma preserved	A	NA		4.4	Y	Absent		A2-537-PFOA/PFOS(14)

*Values in parentheses indicate holding time in days

Project Name:	Not Specified	**Lab Number:**	L1734538
Project Number:	20107	**Report Date:**	10/11/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	Not Specified	**Lab Number:**	L1734538
Project Number:	20107	**Report Date:**	10/11/17

Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name:	Not Specified	**Lab Number:**	L1734538
Project Number:	20107	**Report Date:**	10/11/17

REFERENCES

19 Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

120 Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography/Mass Spectrometry (GC/MS) with Selected Ion Monitoring (SIM). EPA Method 522, EPA/600/R-08/101. Version 1.0, September 2008.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

122 Determination of Selected Perfluorintated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). EPA Method 537, EPA/600/R-08/092. Version 1.1, September 2009.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

MANSFIELD CHAIN OF CUSTODY

PAGE_____ OF _____

ALPHA ANALYTICAL
WESTBORO, MA TEL: 508-898-9220 FAX: 508-898-9193
MANSFIELD, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab: 9/27/17

ALPHA Job #: L1734538

Client Information

Client: Blueleaf, Inc.
Address: 57 Dresser Hill Rd.
Charlton, MA 01507
Phone: 774 200 8029
Fax:
Email: cgrotton@blueleafwater.com
☐ These samples have been previously analyzed by Alpha

Project Information

Project Name:
Project Location:
Project #:
Project Manager:
ALPHA Quote #:

Turn-Around Time

☐ Standard ☐ RUSH (only confirmed if pre-approved!)
Date Due: Time:

Report Information - Data Deliverables

☐ FAX ☐ EMAIL
☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State /Fed Program | Criteria

Other Project Specific Requirements/Comments/Detection Limits:

PLEASE NOTE
MS/MSD (at unit cost) will be omitted unless you check here: ☐

ANALYSIS: Total Fe, Mn | pH, Alky, Turb | 1,4 Dioxane | PFOS/PFOA

SAMPLE HANDLING
Filtration
☐ Done
☐ Not needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Total Fe, Mn	pH, Alky, Turb	1,4 Dioxane	PFOS/PFOA	Sample Specific Comments	TOTAL # BOTTLES
34558-01	Raw-13	9/27	10:00	DW	AZD	X	X	X	X		8
02	Trojan-13	↓	↓	↓	↓	X		X			3
03	Filter E-13					X		X	X		6
04	Filter F-13					X		X	X		6
05	Field Blank								X		1

Container Type
Preservative

Relinquished By:	Date/Time	Received By:	Date/Time
	9/27/17 14:11	AAL	9/27/17 14:11

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

Figure C01: Filter A Operational Data
Trial 1 - July 17-18, 2017 (Wells 3)

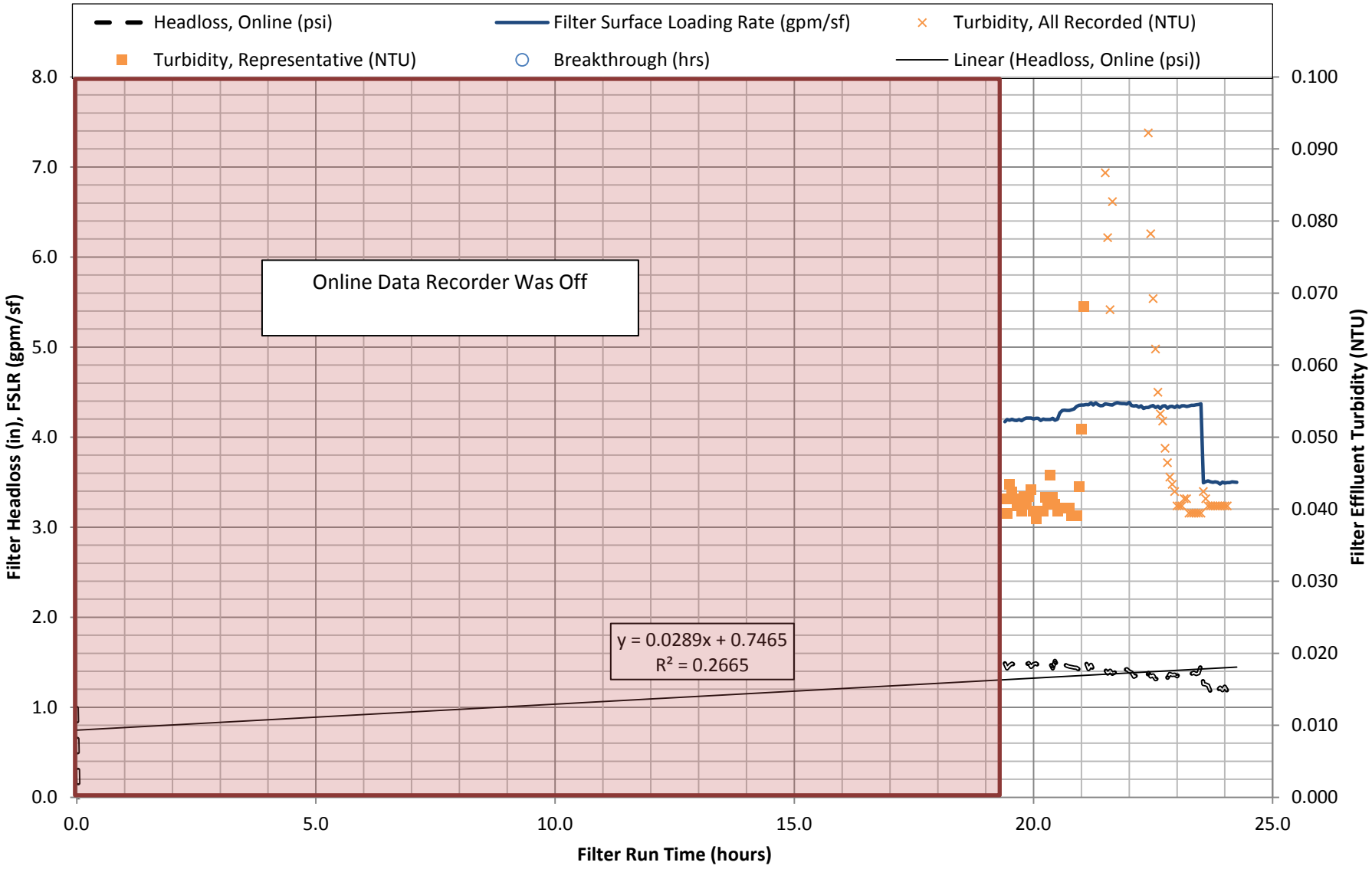


Figure C02: Filter B Operational Data
Trial 1 - July 17-18, 2017 (Wells 3)

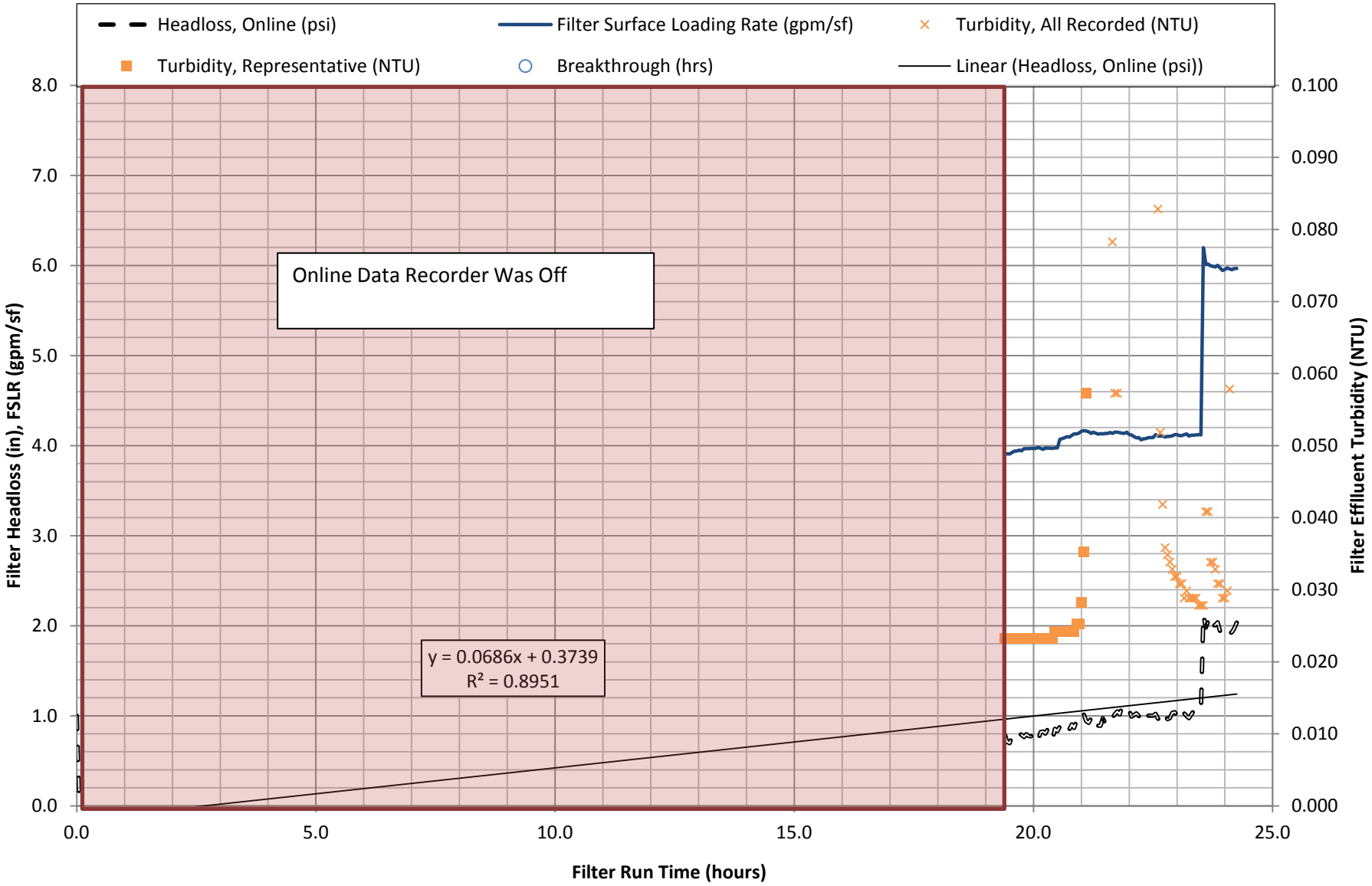


Figure C03: Filter C Operational Data
Trial 1 - July 17-18, 2017 (Wells 3)

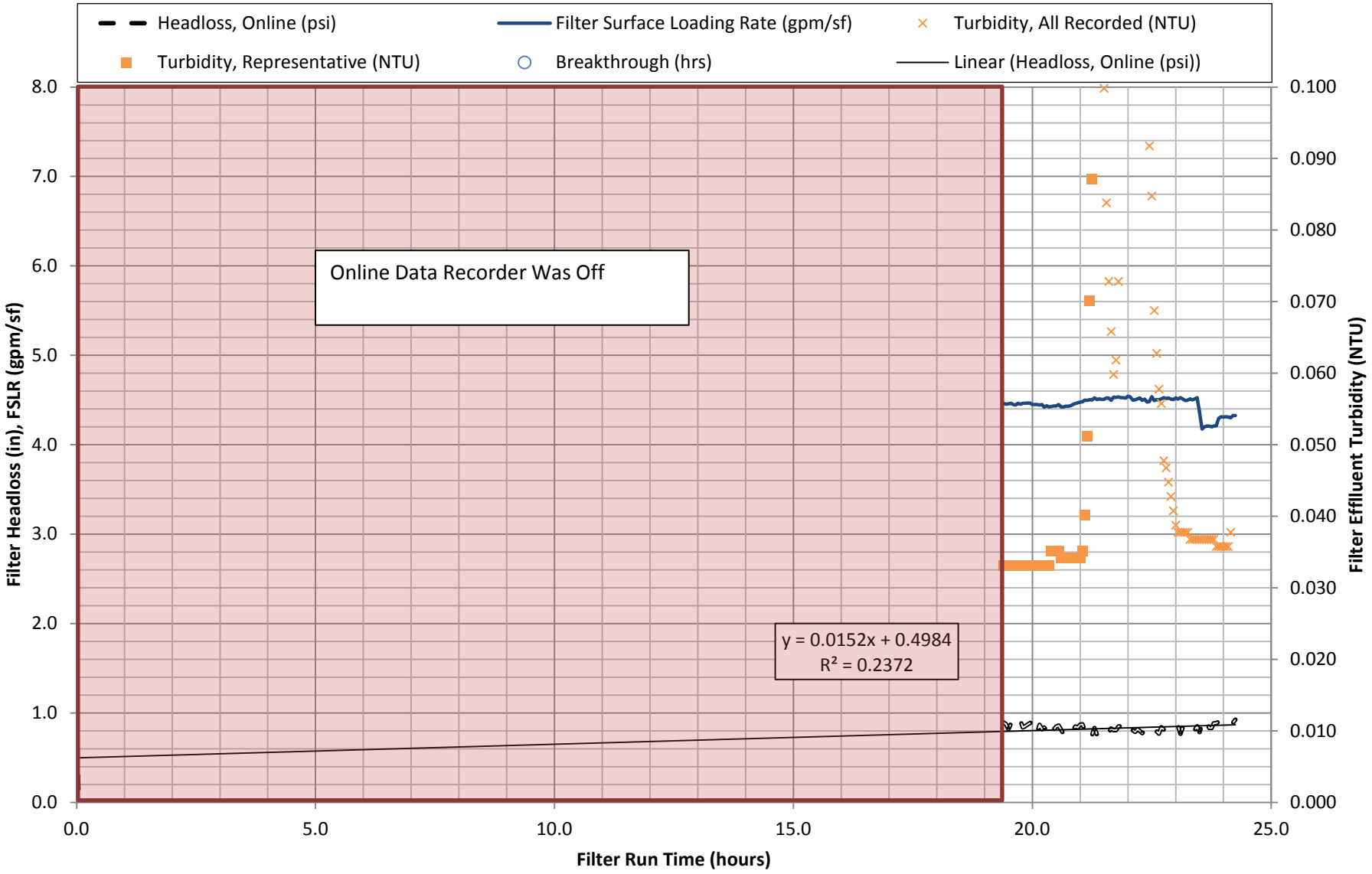


Figure C04: Filter D Operational Data
Trial 1 - July 17-18, 2017 (Wells 3)

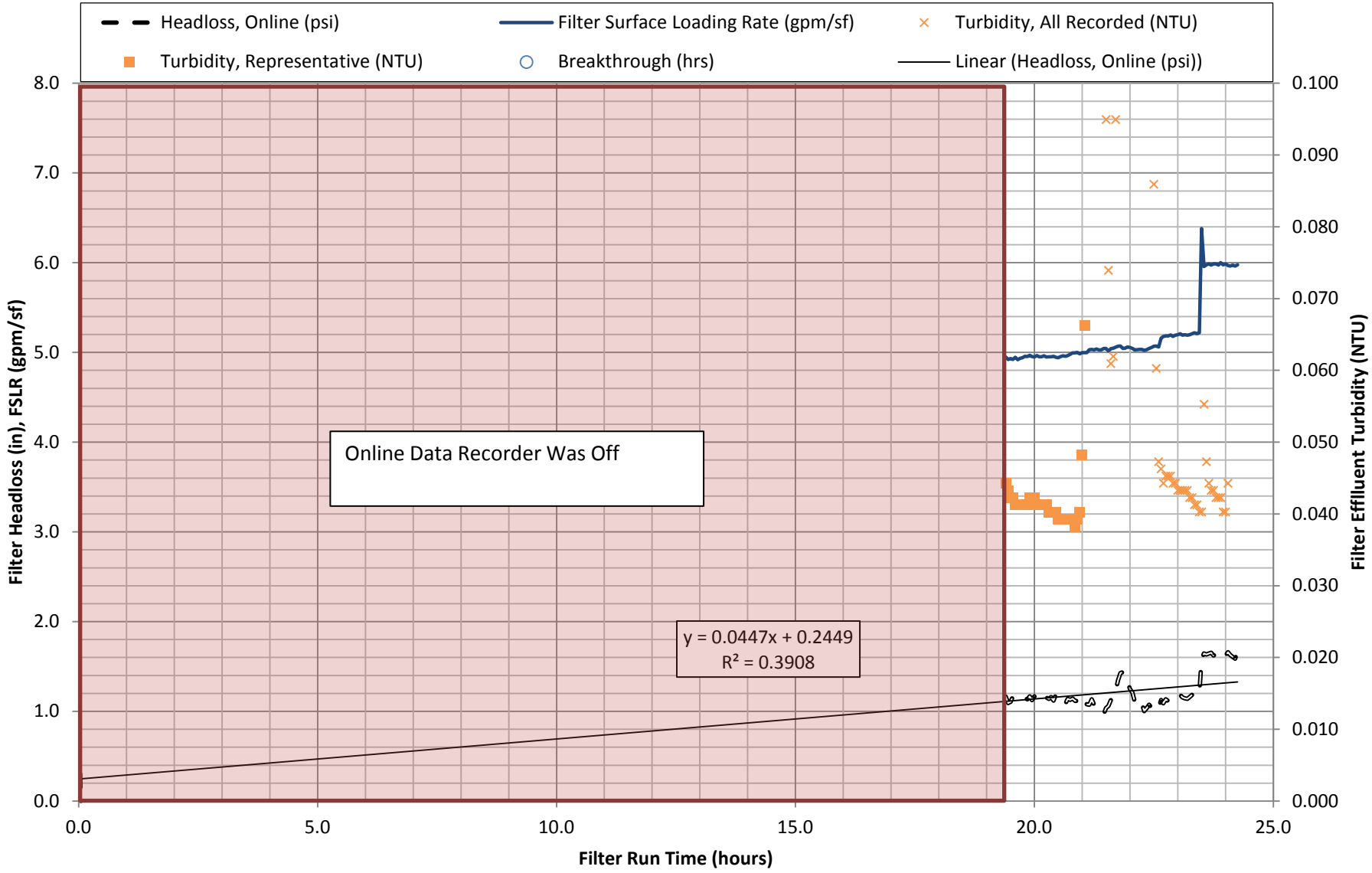


Figure C05: Filter A Operational Data
Trial 2 - July 19-20, 2017 (Wells 1, 2 & 3)

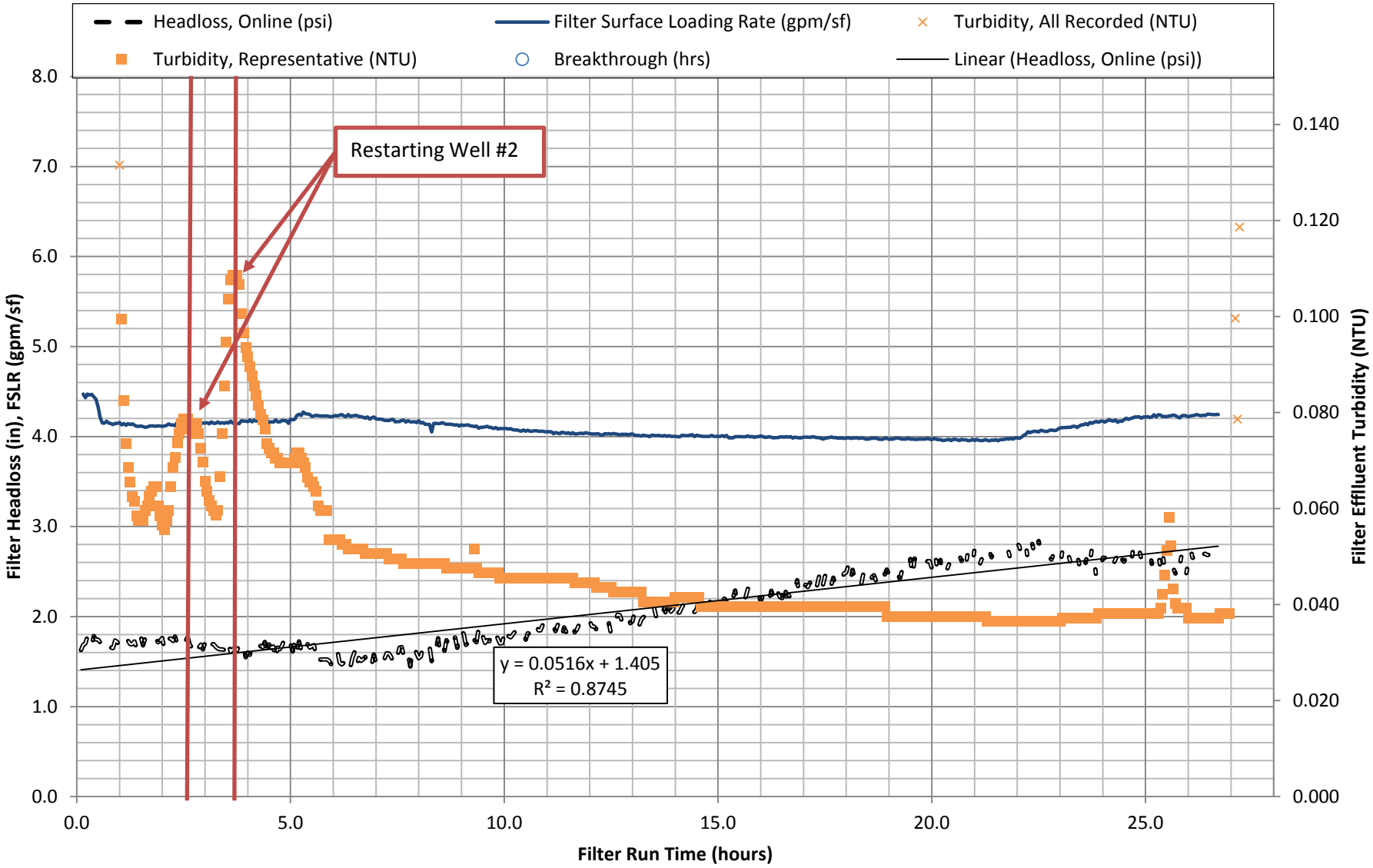


Figure C06: Filter B Operational Data
Trial 2 - July 19-20, 2017 (Wells 1, 2 & 3)

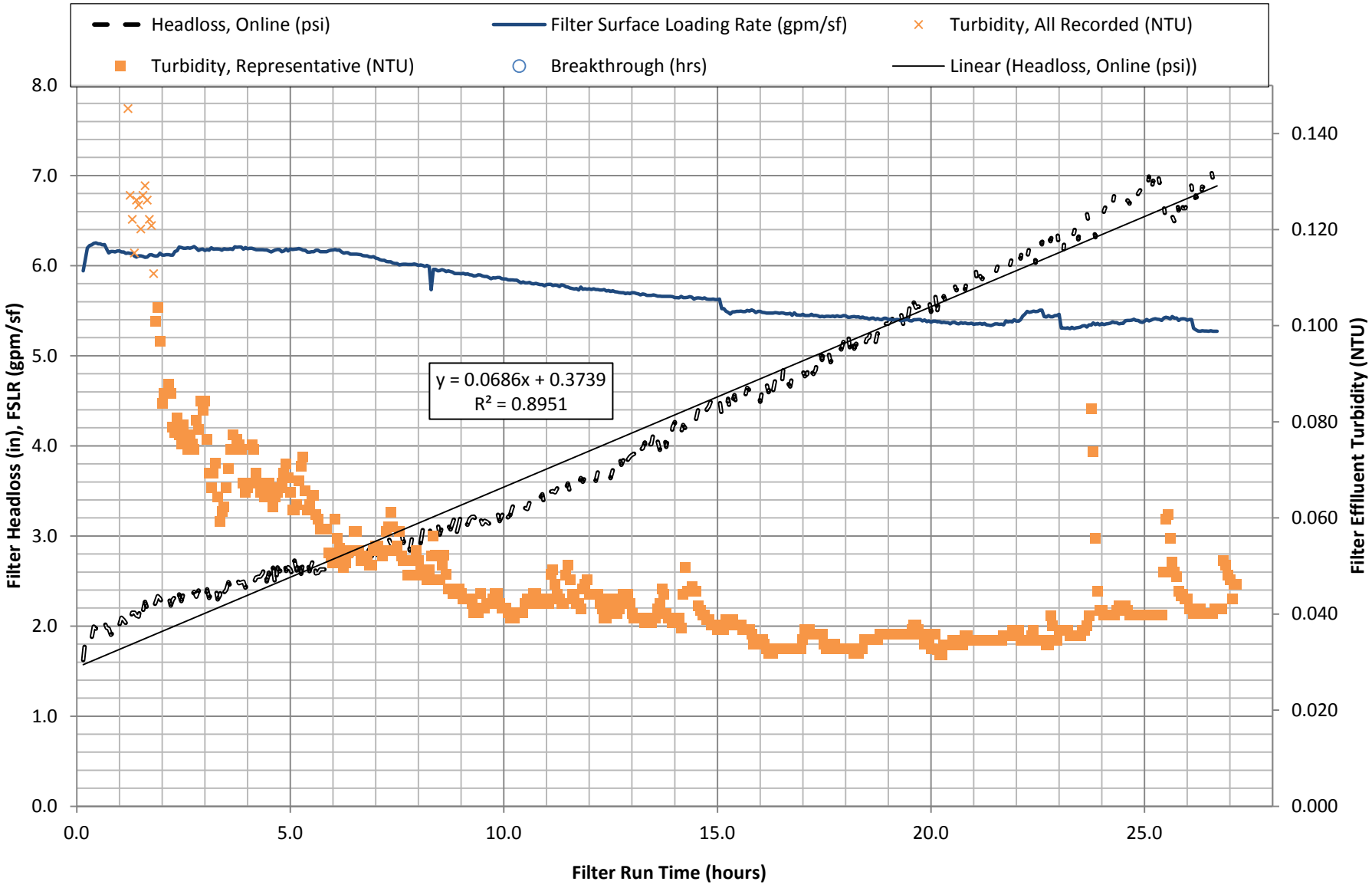


Figure C07: Filter C Operational Data
Trial 2 - July 19-20, 2017 (Wells 1, 2 & 3)

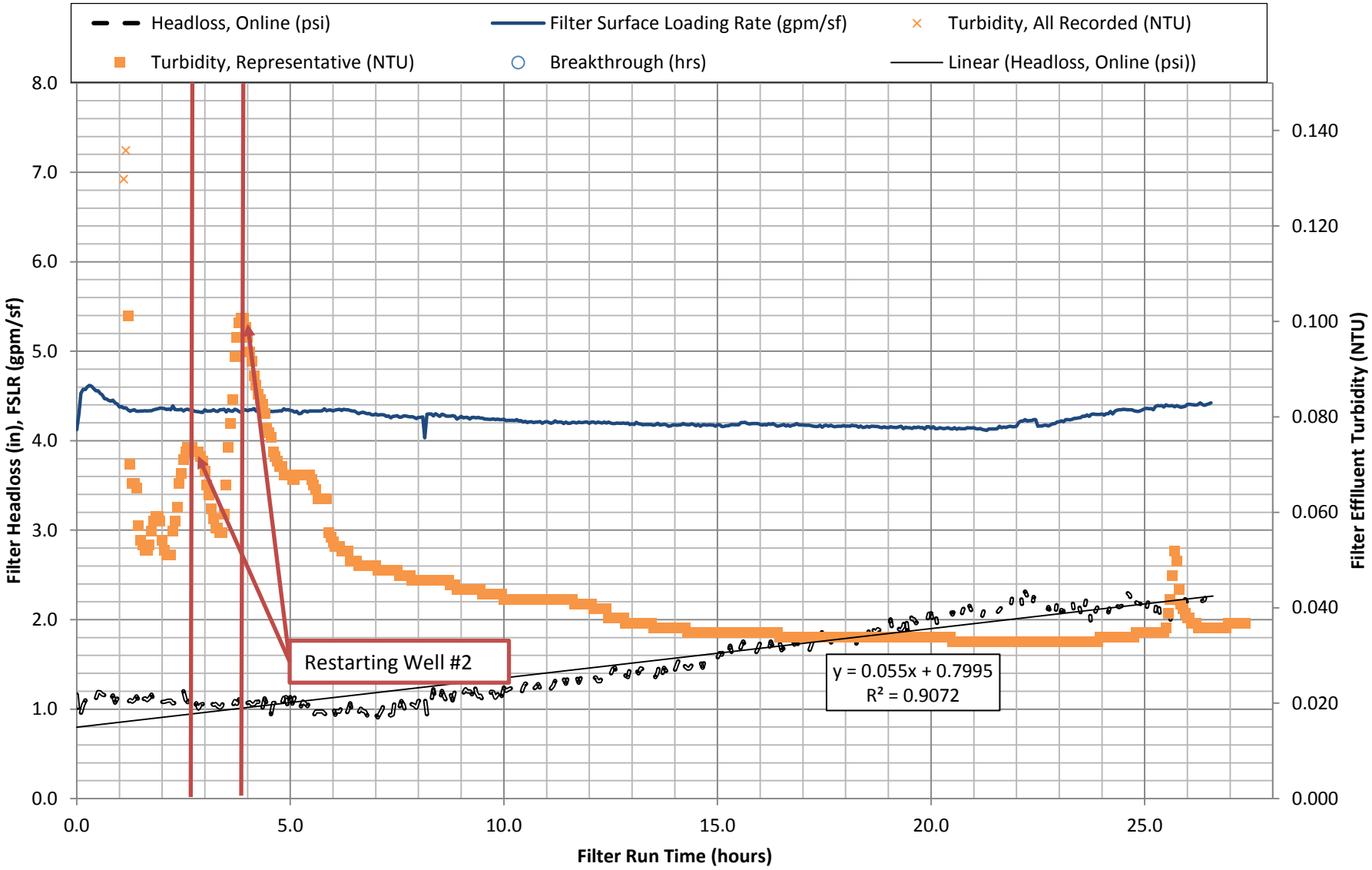


Figure C08: Filter D Operational Data
Trial 2 - July 19-20, 2017 (Wells 1, 2 & 3)

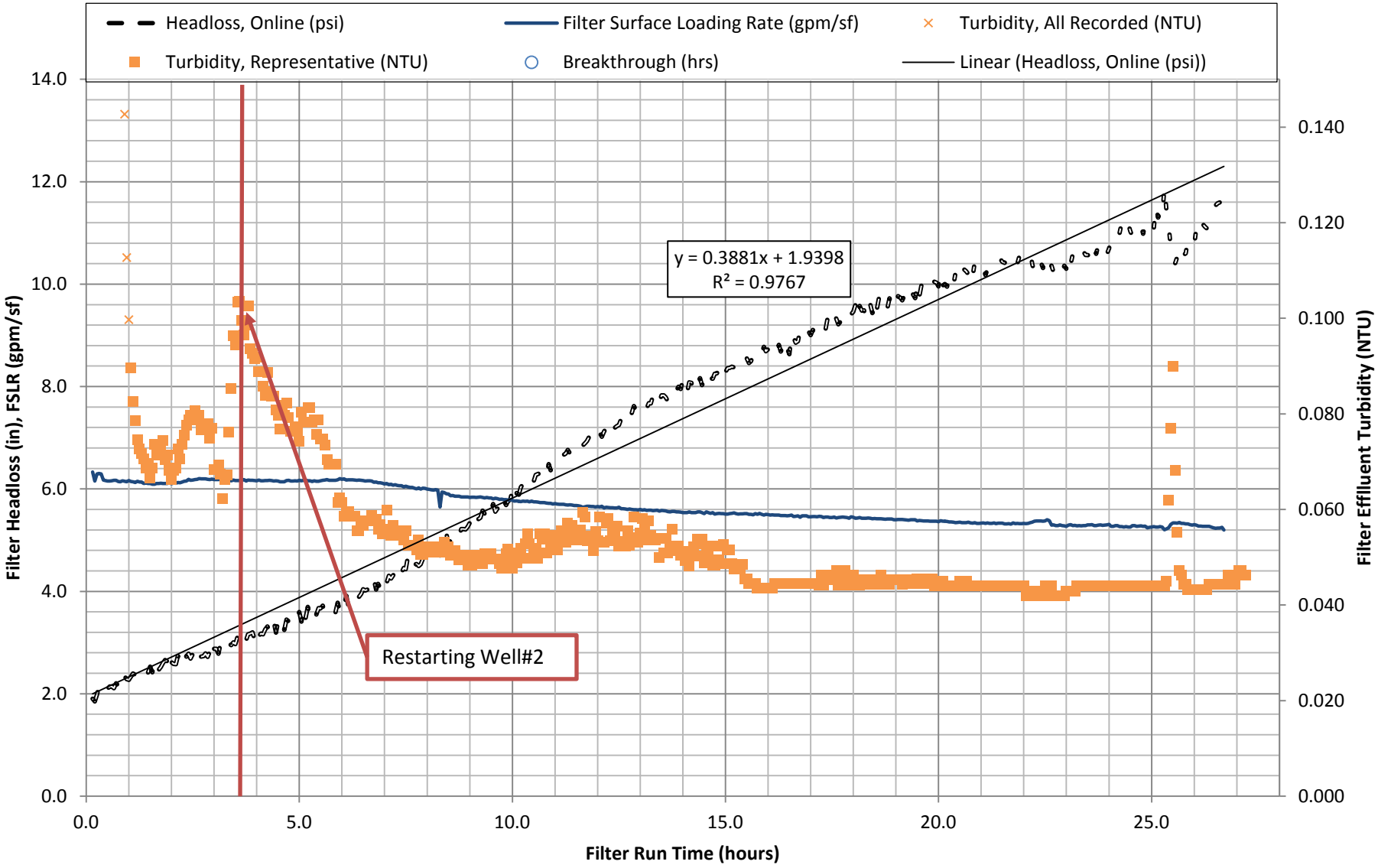


Figure C09: Filter A Operational Data
Trial 3 - July 20-21, 2017 (Wells 1 & 3)

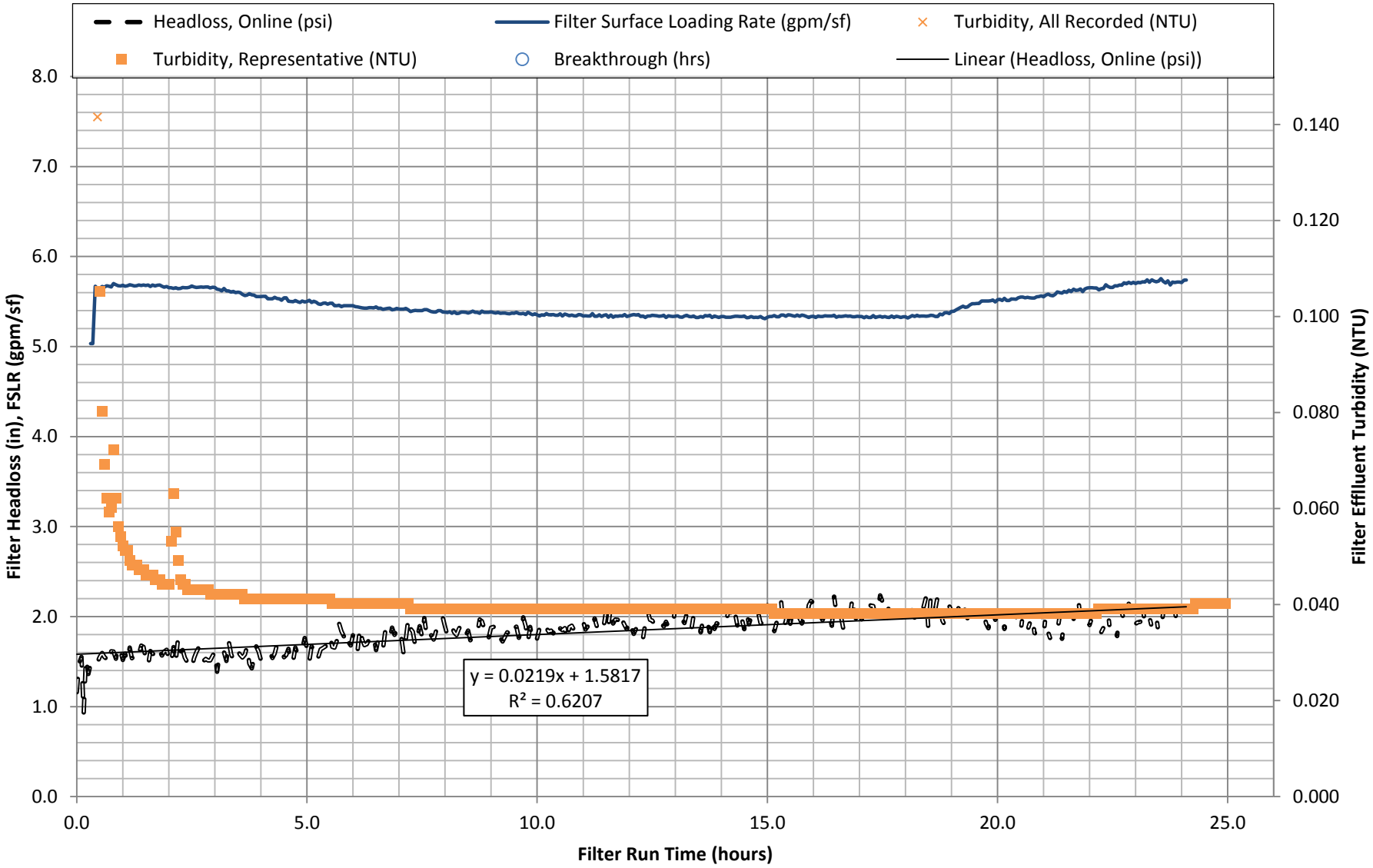


Figure C10: Filter B Operational Data
Trial 3 - July 20-21, 2017 (Wells 1 & 3)

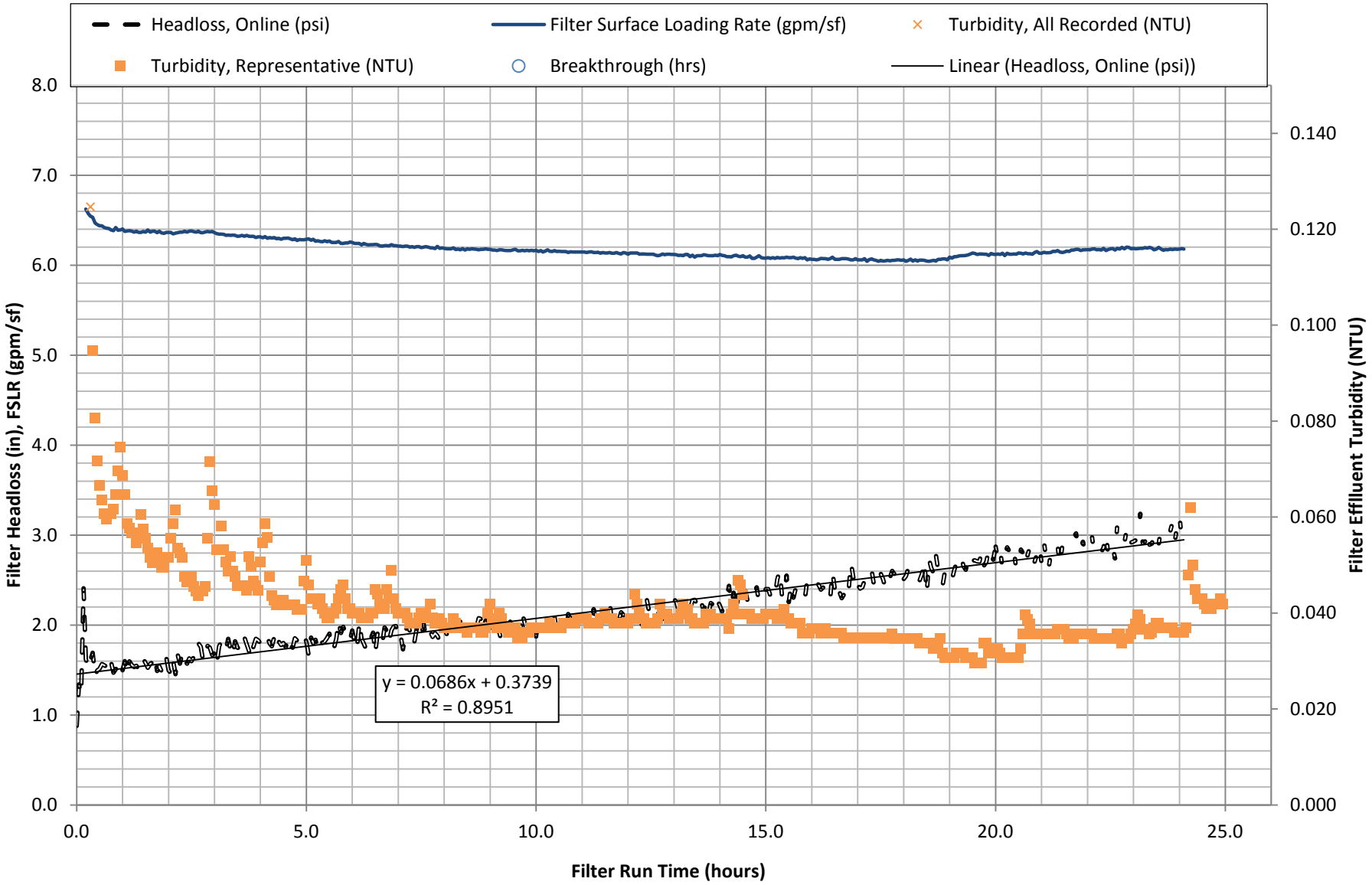


Figure C11: Filter C Operational Data
Trial 3 - July 20-21, 2017 (Wells 1 & 3)

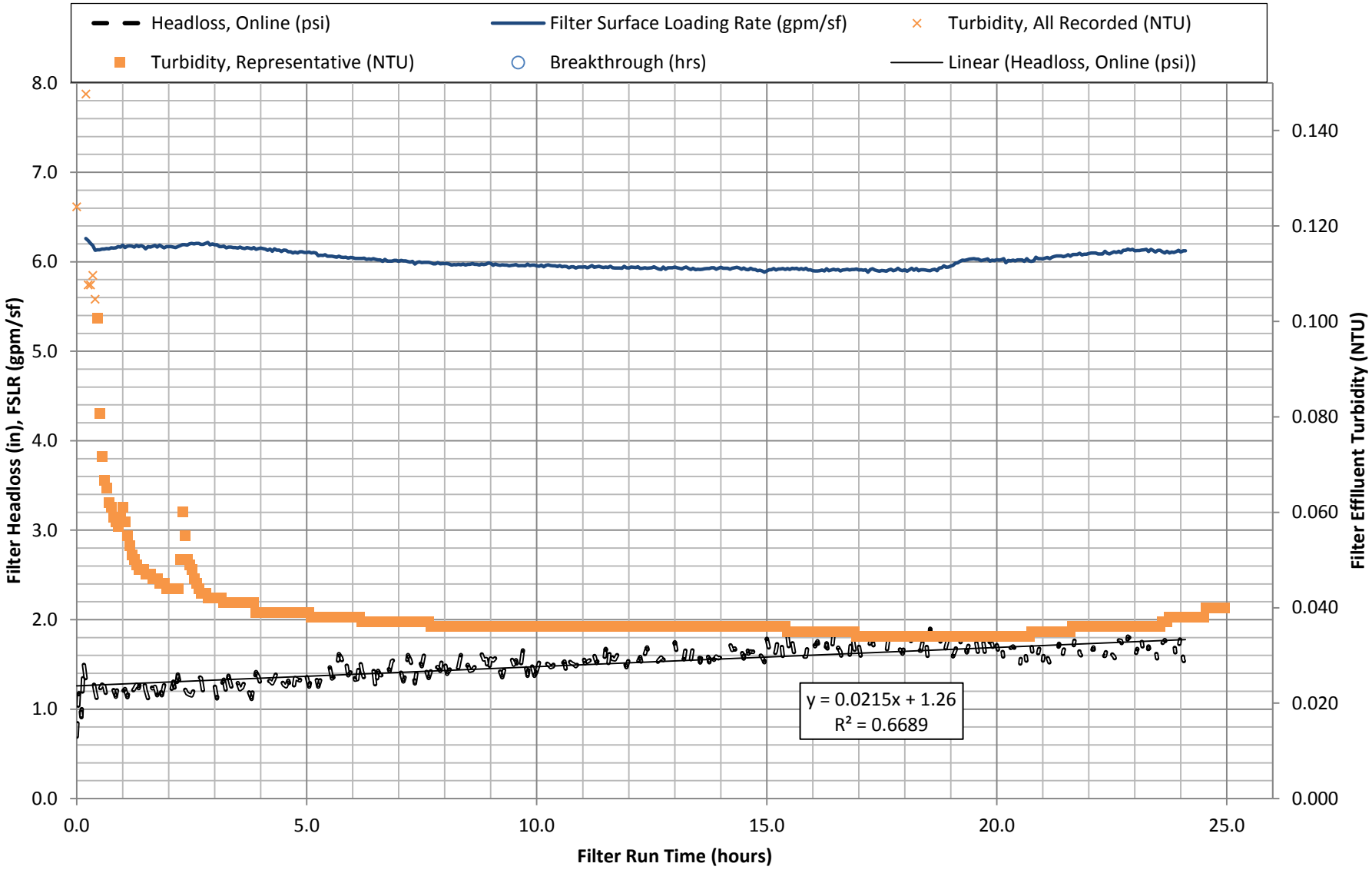


Figure C12: Filter D Operational Data
Trial 3 - July 20-21, 2017 (Wells 1 & 3)

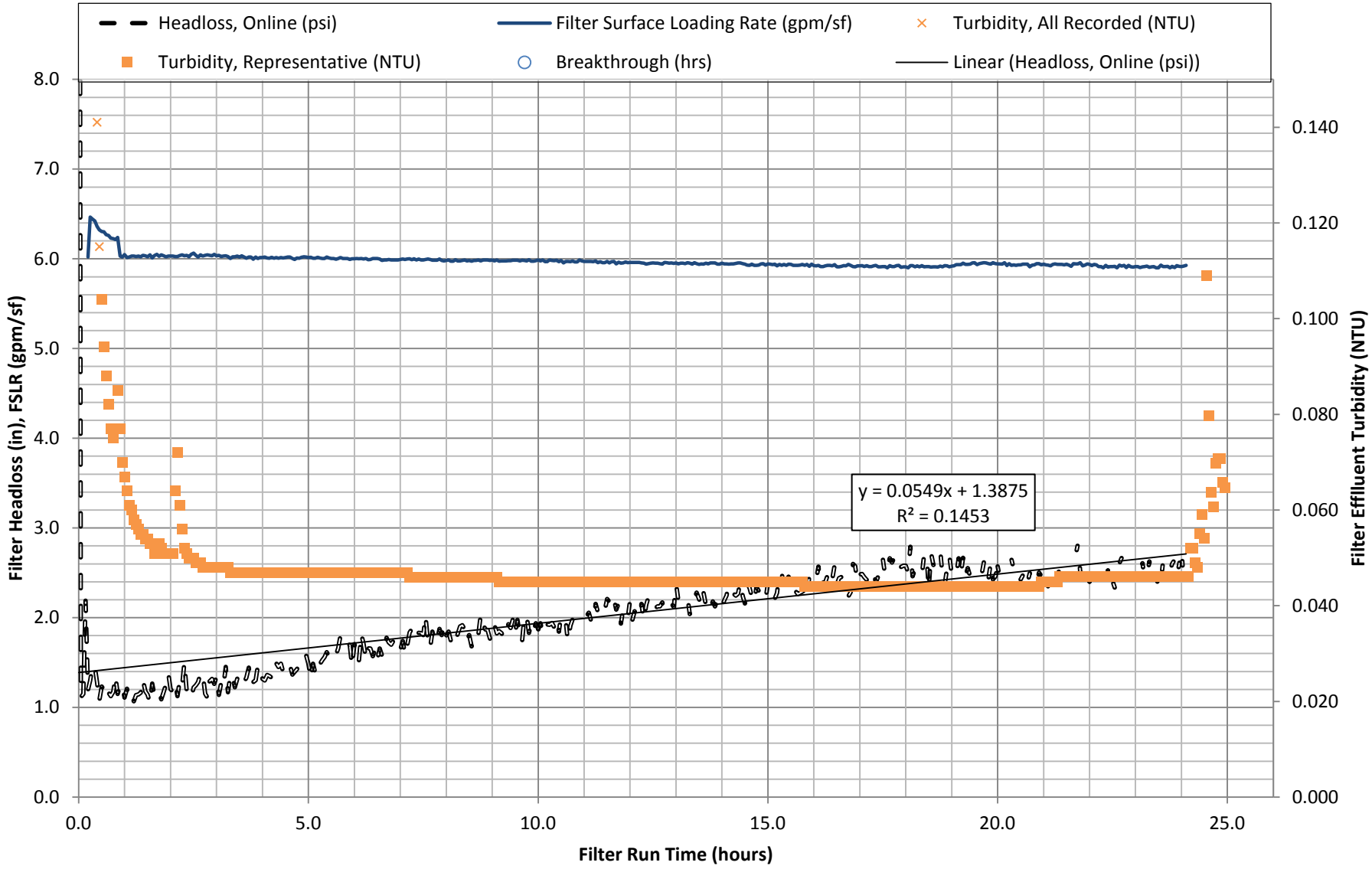


Figure C13: Filter A Operational Data
Trial 4 - July 24, 2017 (Well 3)

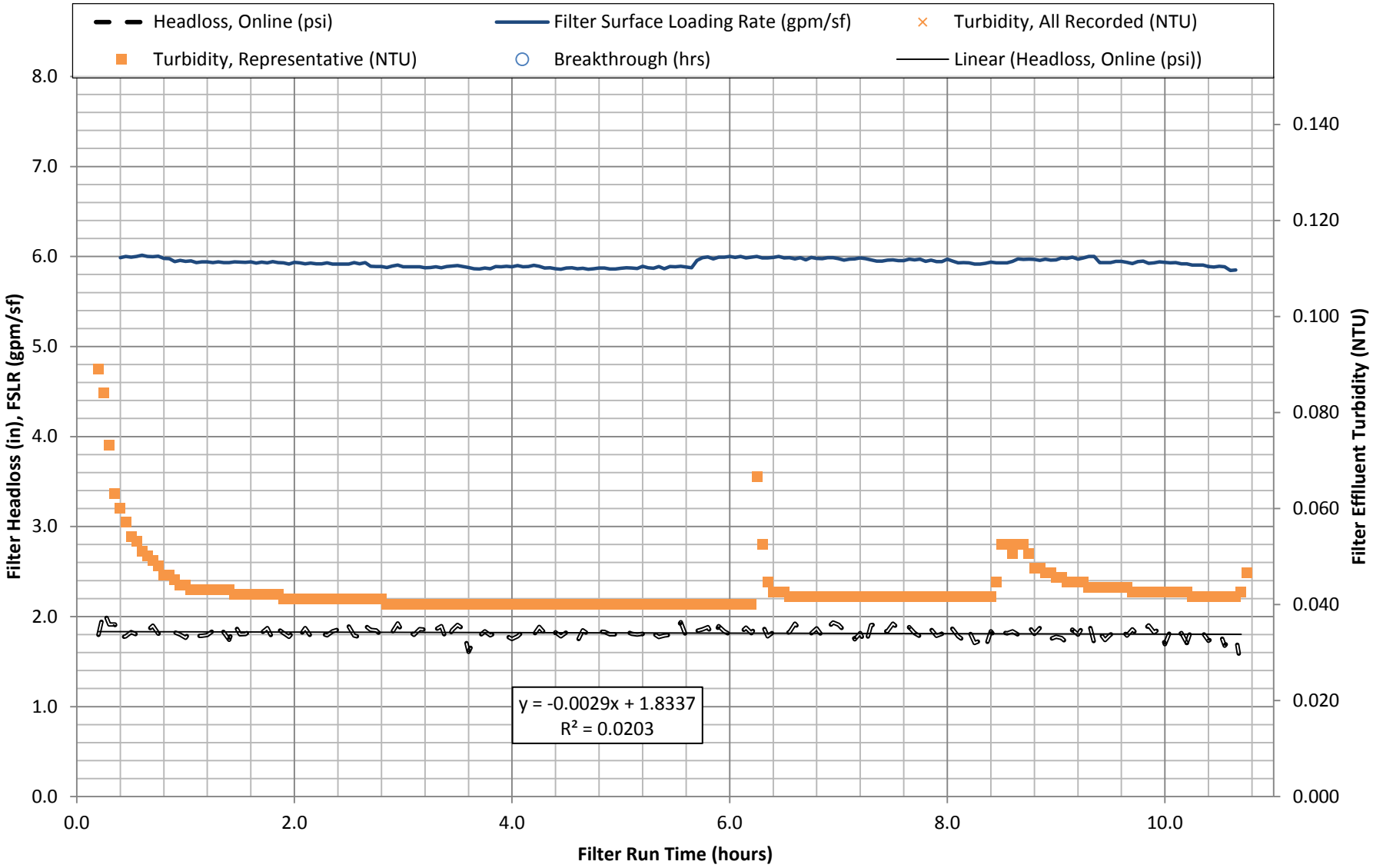


Figure C14: Filter B Operational Data
Trial 4 - July 24, 2017 (Well 3)

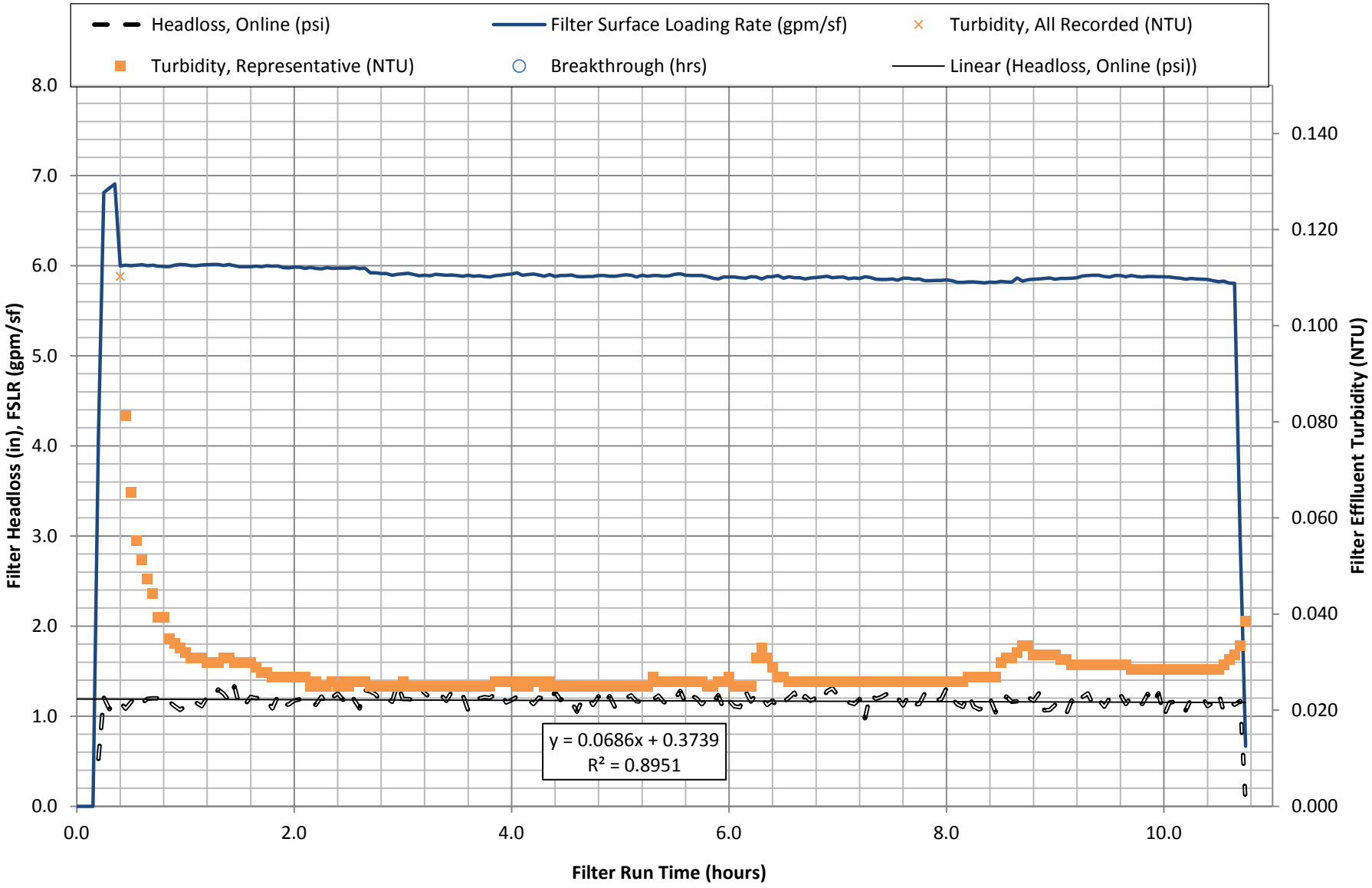


Figure C15: Filter C Operational Data
Trial 4 - July 24, 2017 (Well 3)

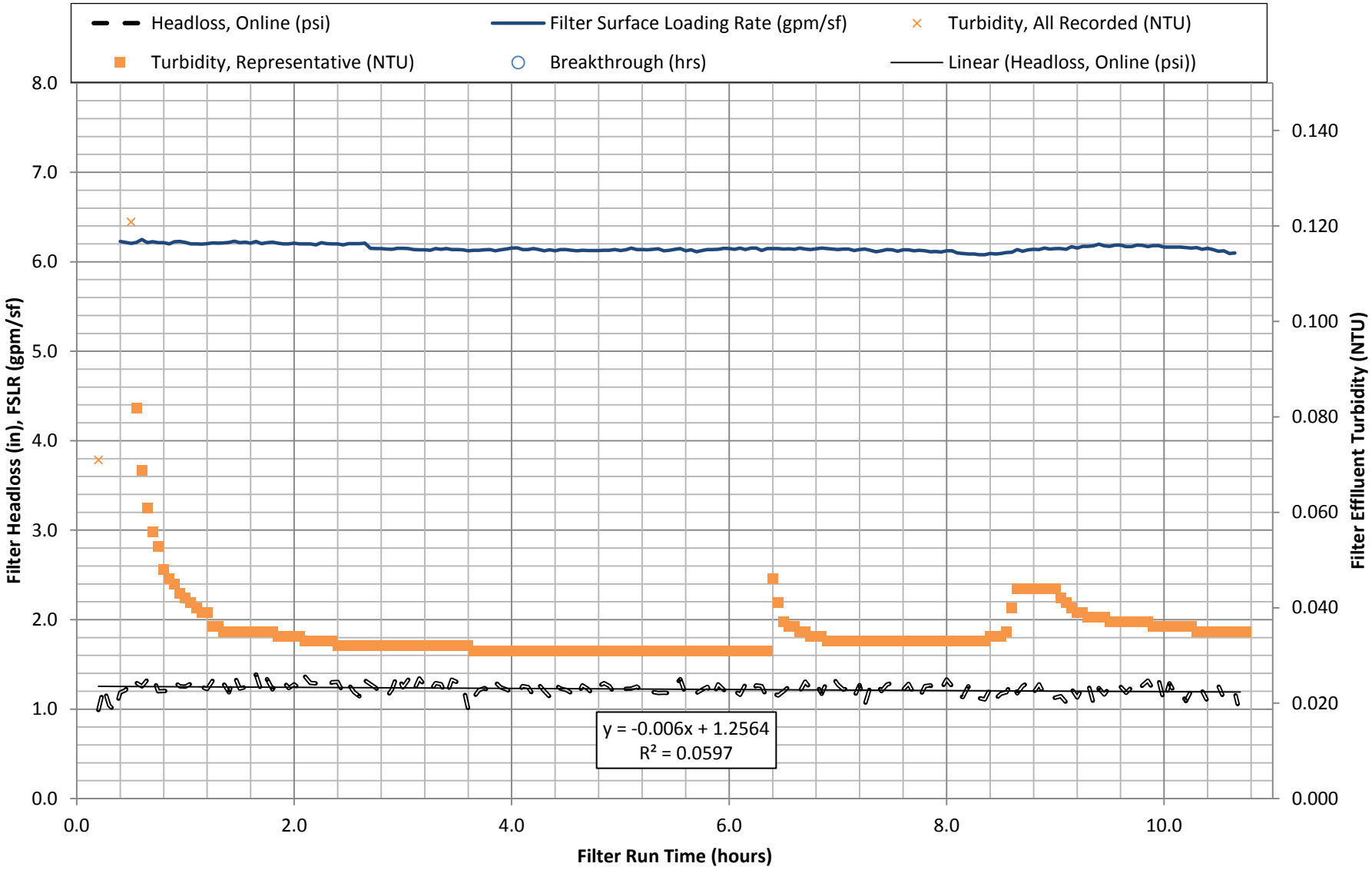


Figure C16: Filter D Operational Data
Trial 4 - July 24, 2017 (Well 3)

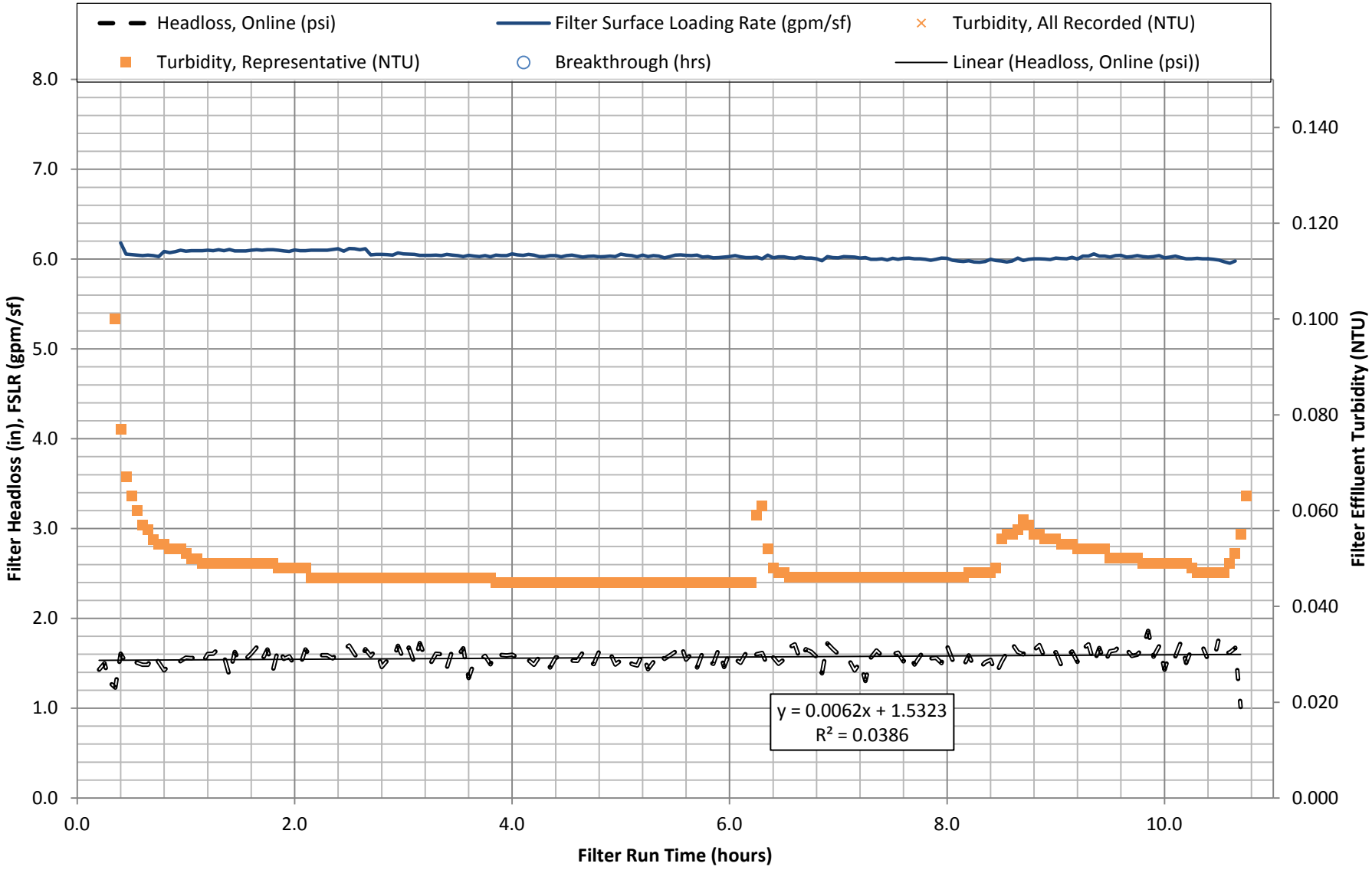


Figure C17: Filter A Operational Data
Trial 5 - July 25, 2017 (Well 3)

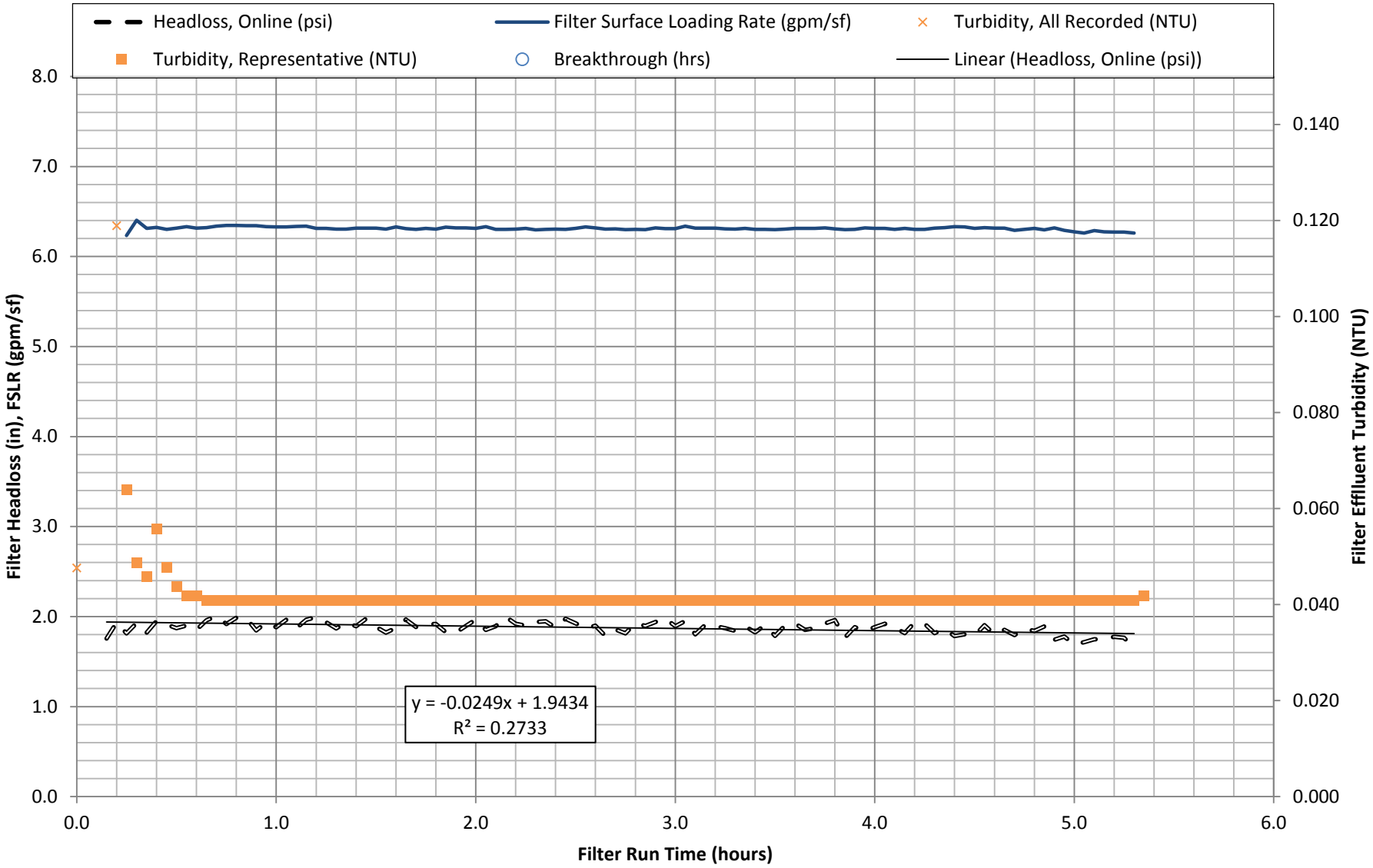


Figure C18: Filter B Operational Data
Trial 4 - July 25, 2017 (Well 3)

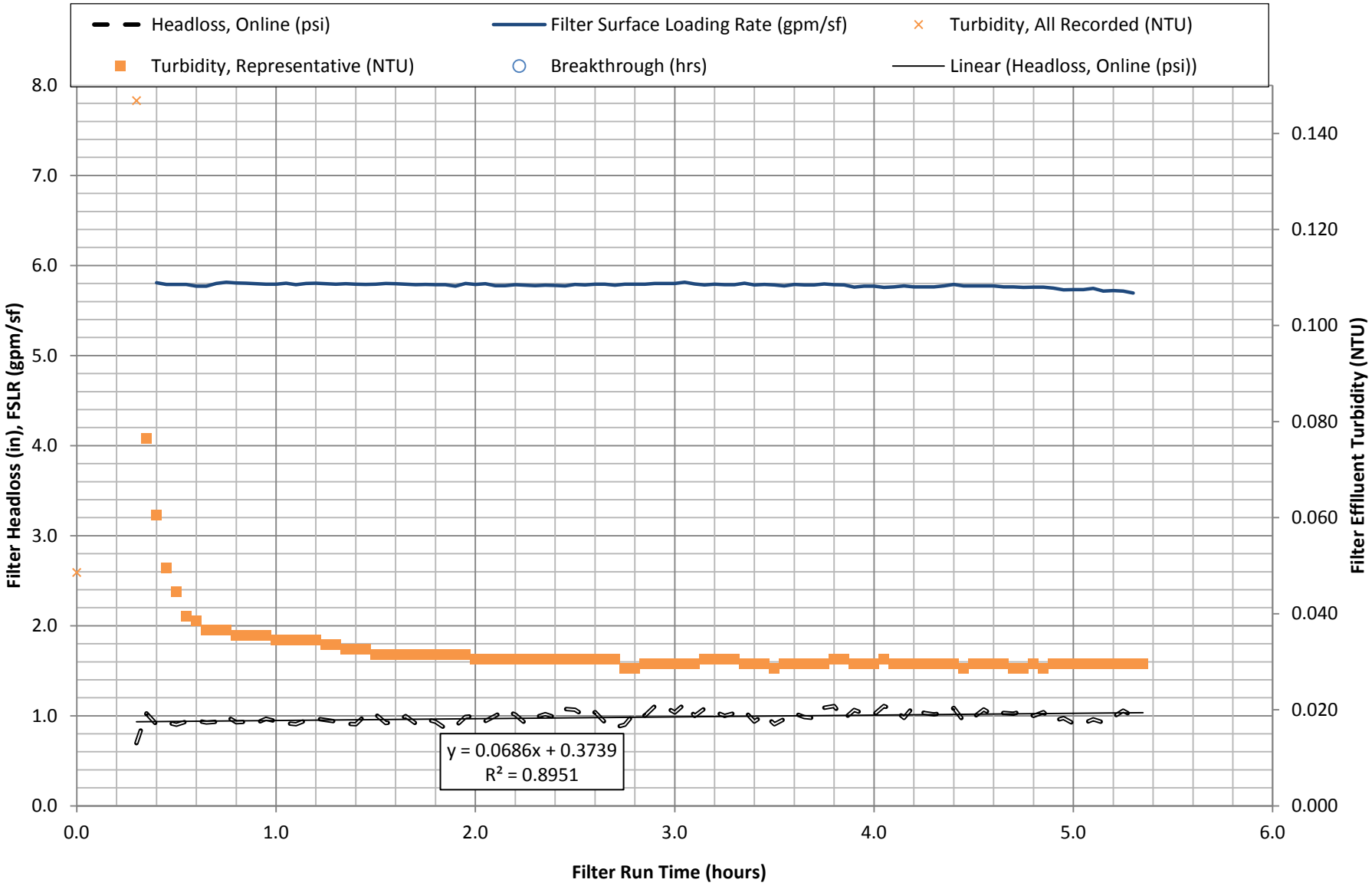


Figure C19: Filter C Operational Data
Trial 5 - July 25, 2017 (Well 3)

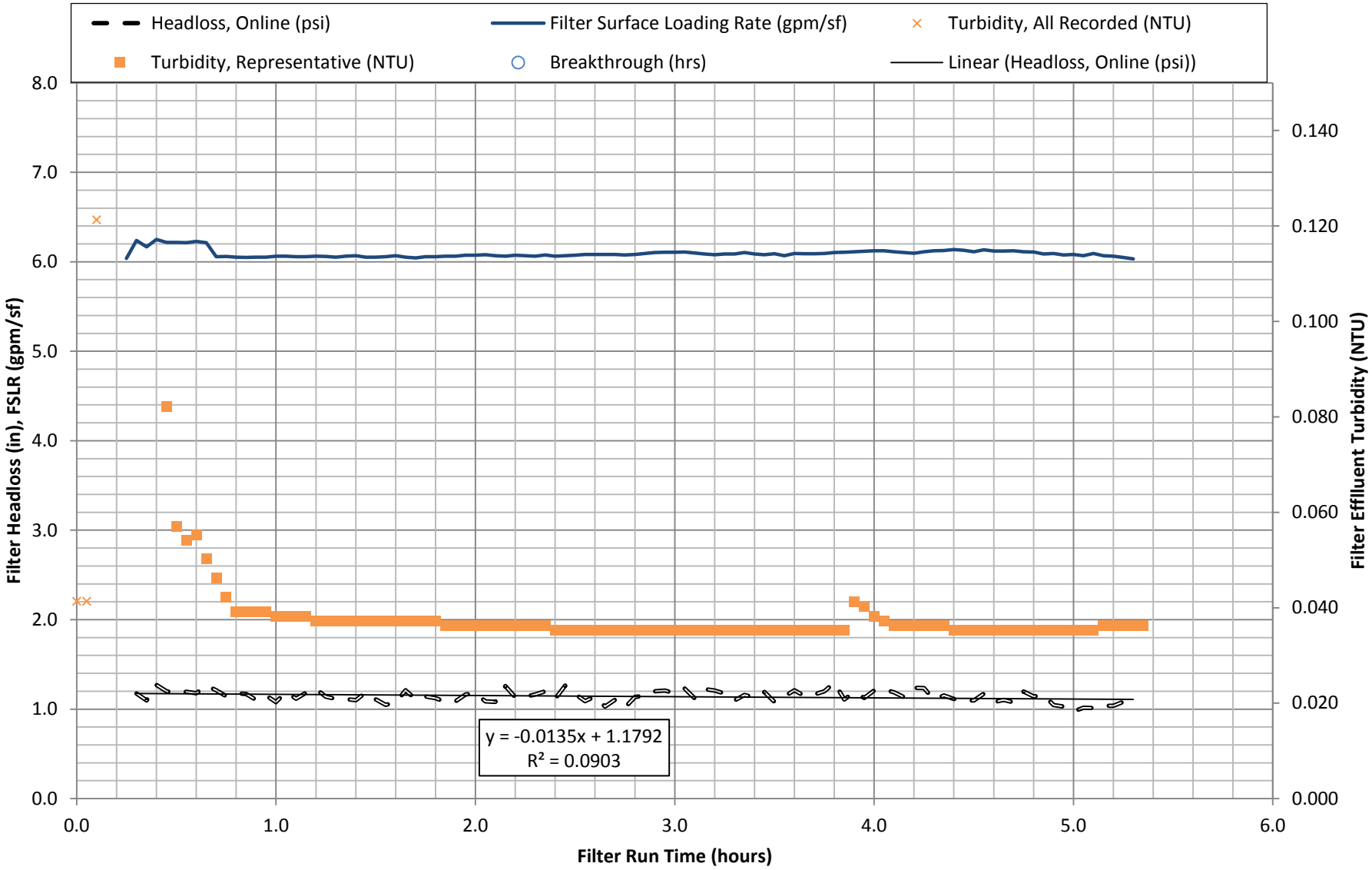


Figure C20: Filter D Operational Data
Trial 5 - July 25, 2017 (Well 3)

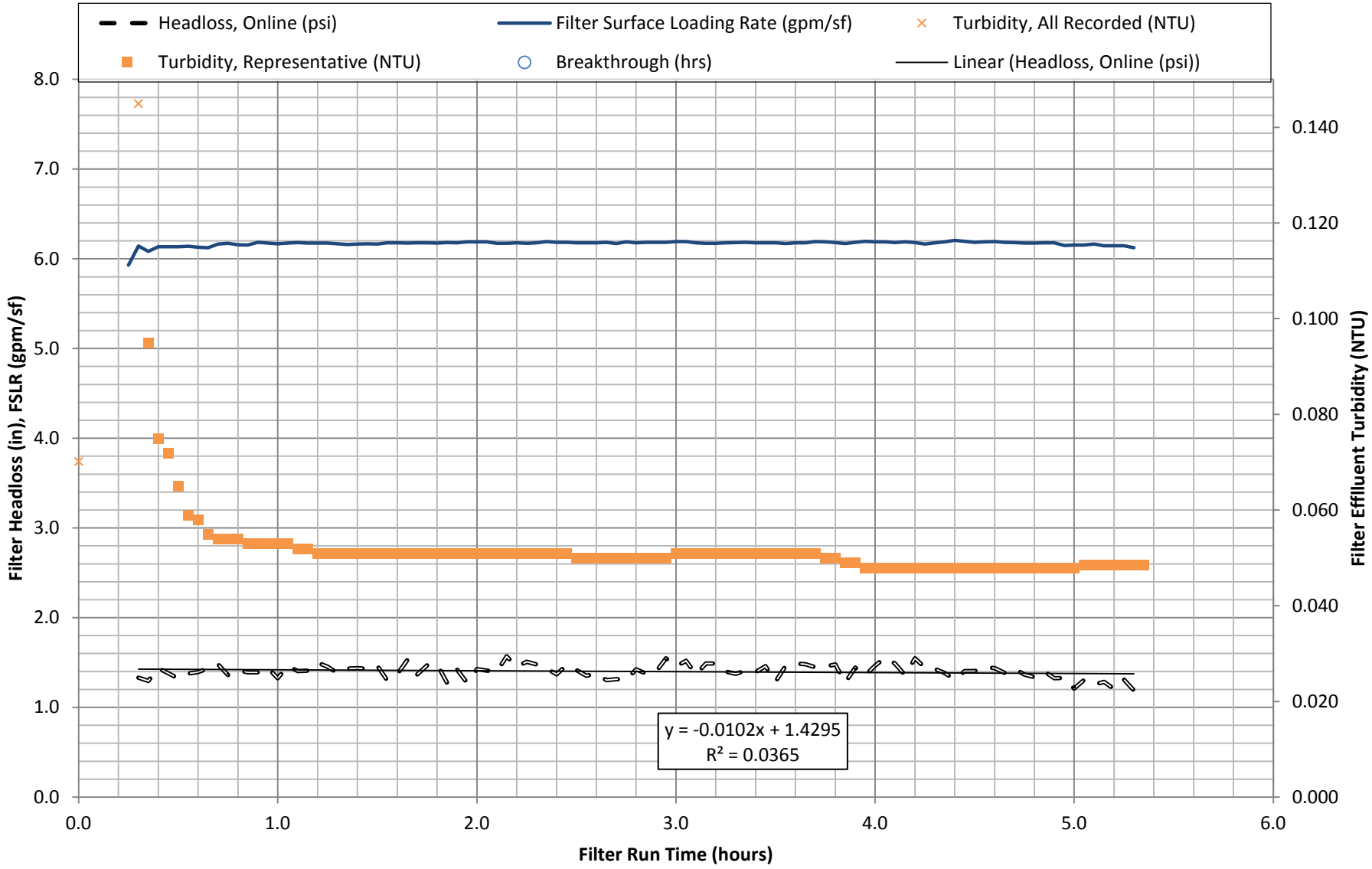


Figure C21: Filter A Operational Data
Trial 6 - July 26-28, 2017 (Wells 1 & 3)

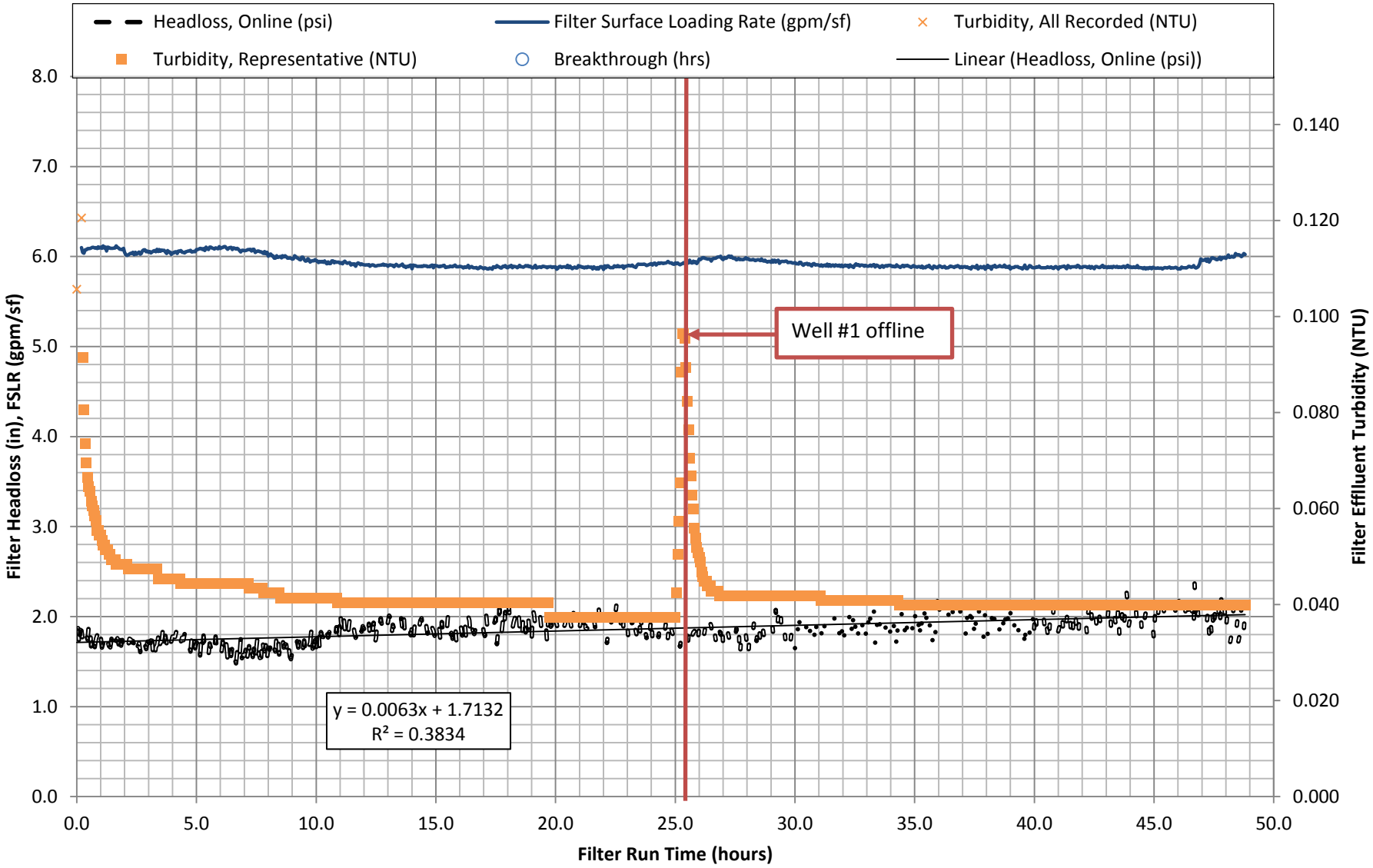


Figure C22: Filter B Operational Data
Trial 6 - July 26-28, 2017 (Wells 1 & 3)

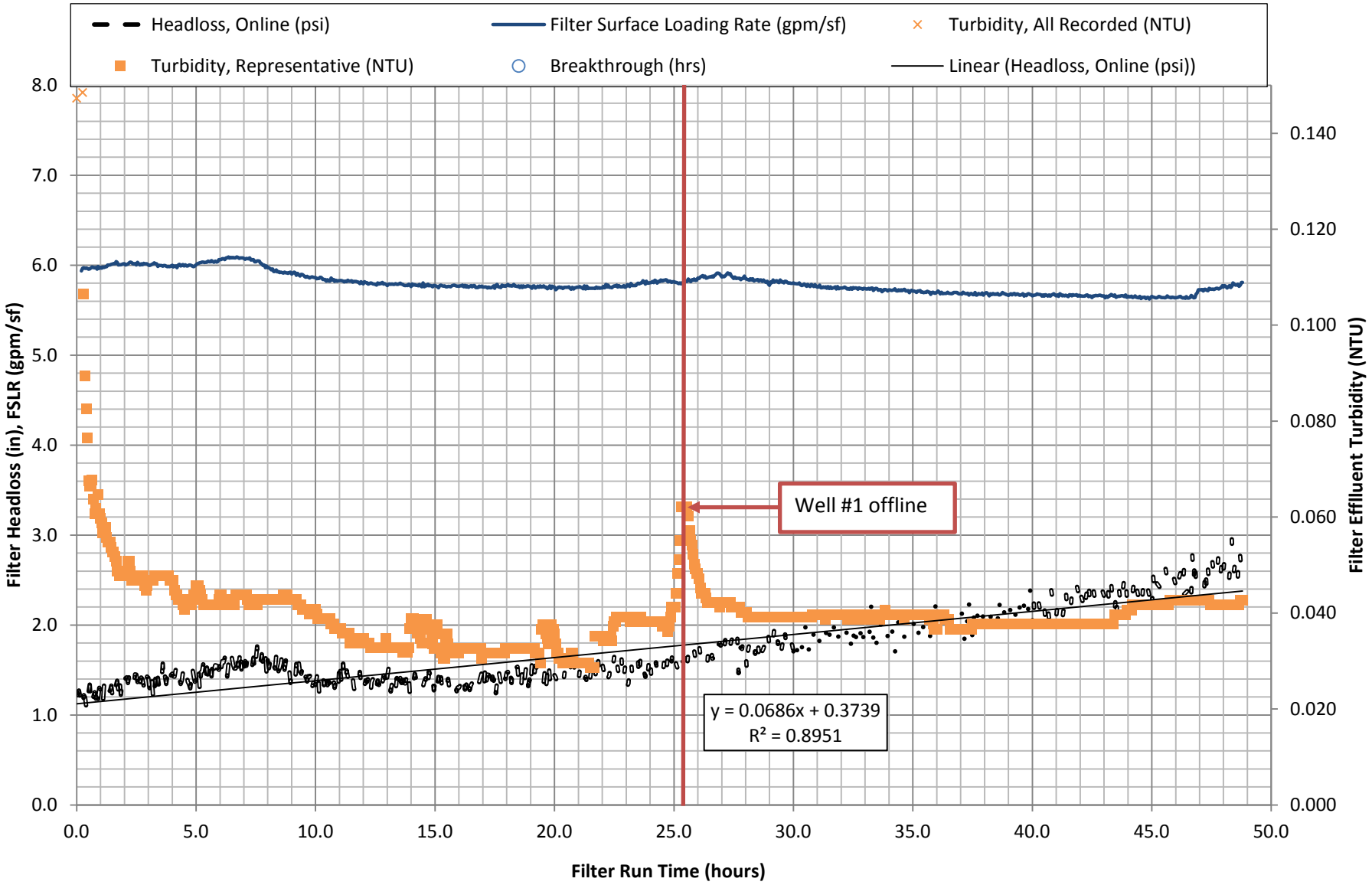


Figure C23: Filter C Operational Data
Trial 6 - July 26-28, 2017 (Wells 1 & 3)

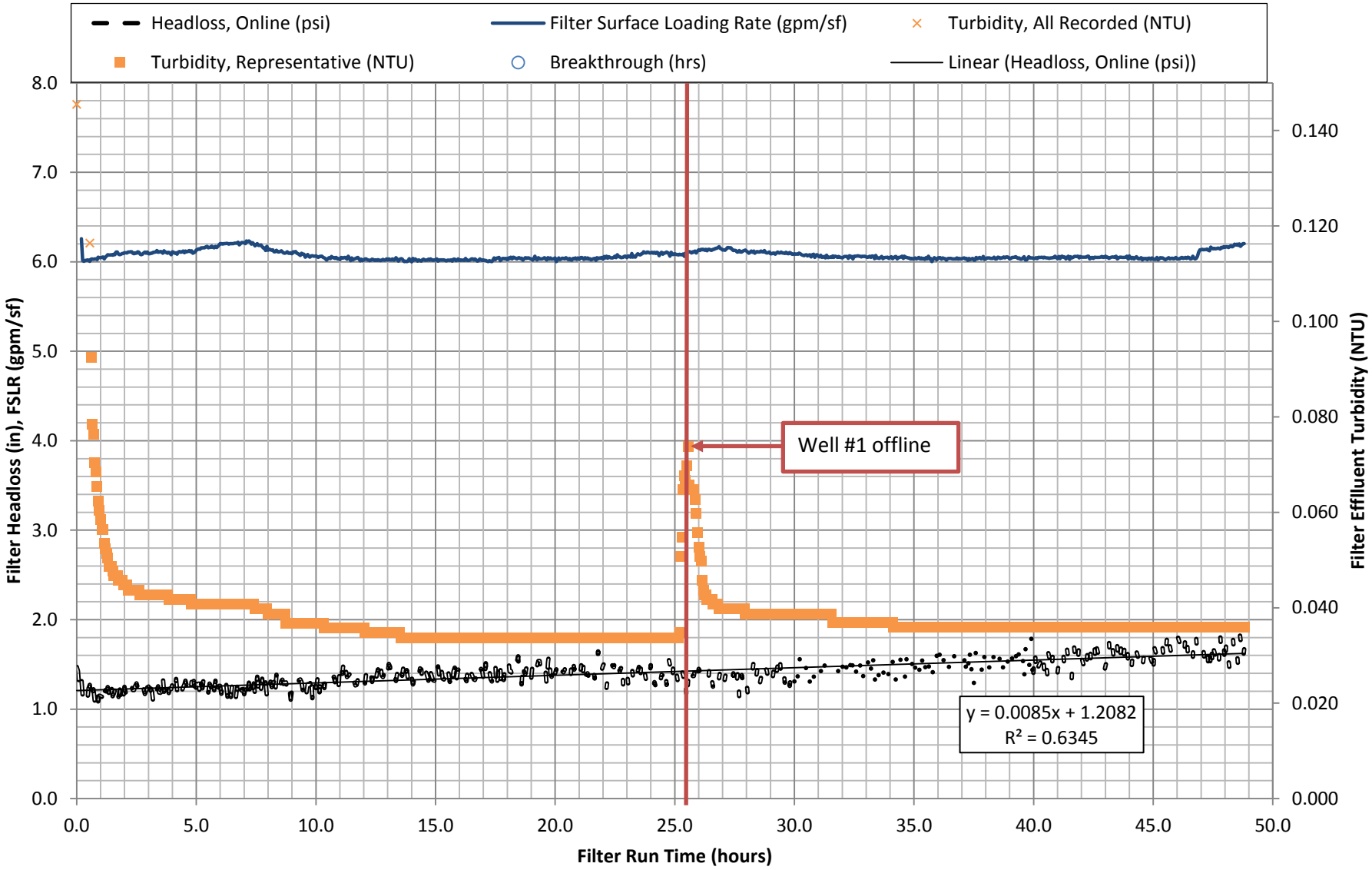


Figure C24: Filter D Operational Data
Trial 6 - July 28-30, 2017 (Wells 1 & 3)

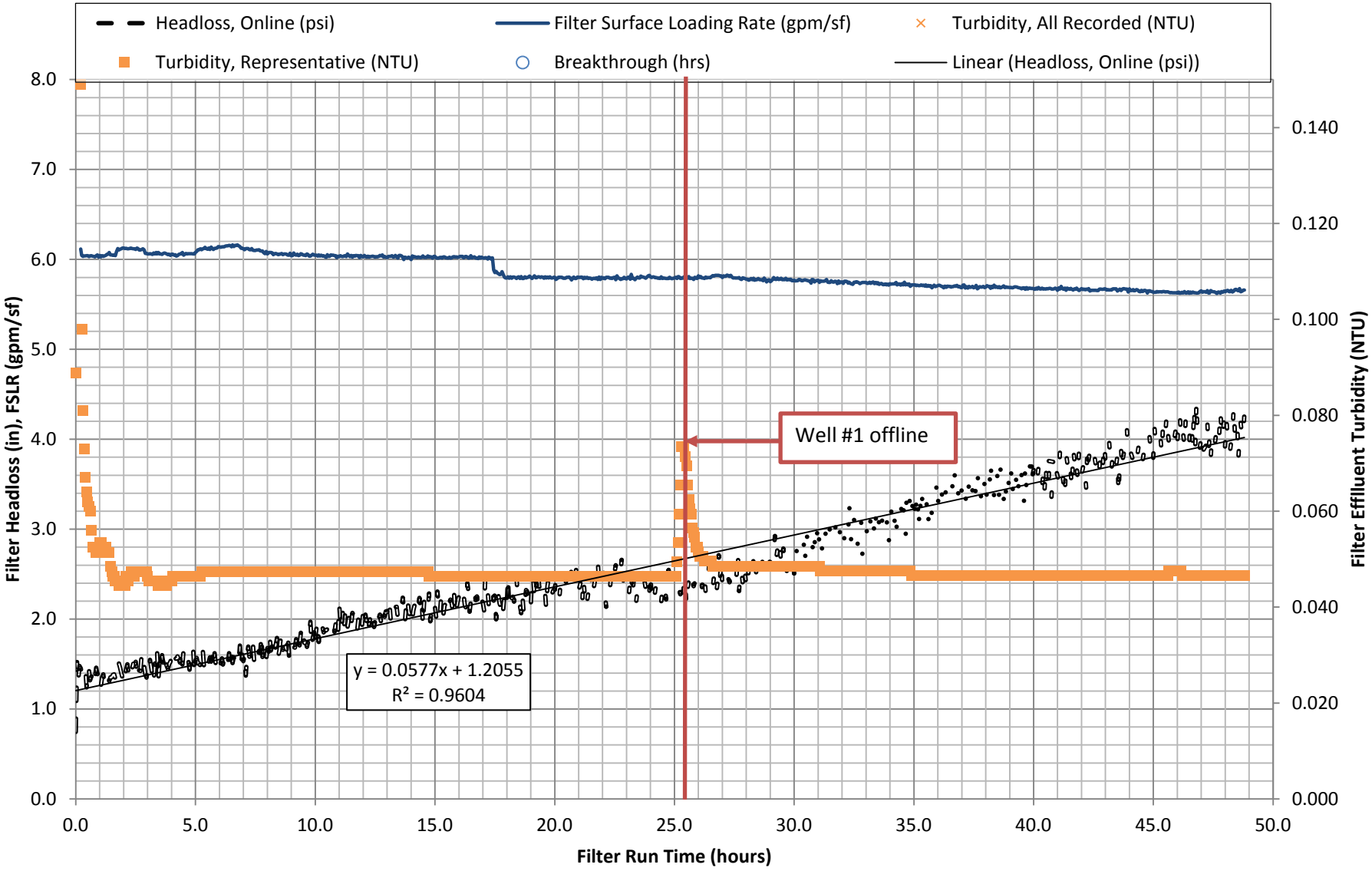


Figure C25: Filter A Operational Data
Trial 7 - July 28-31, 2017 (Wells 1 & 3)

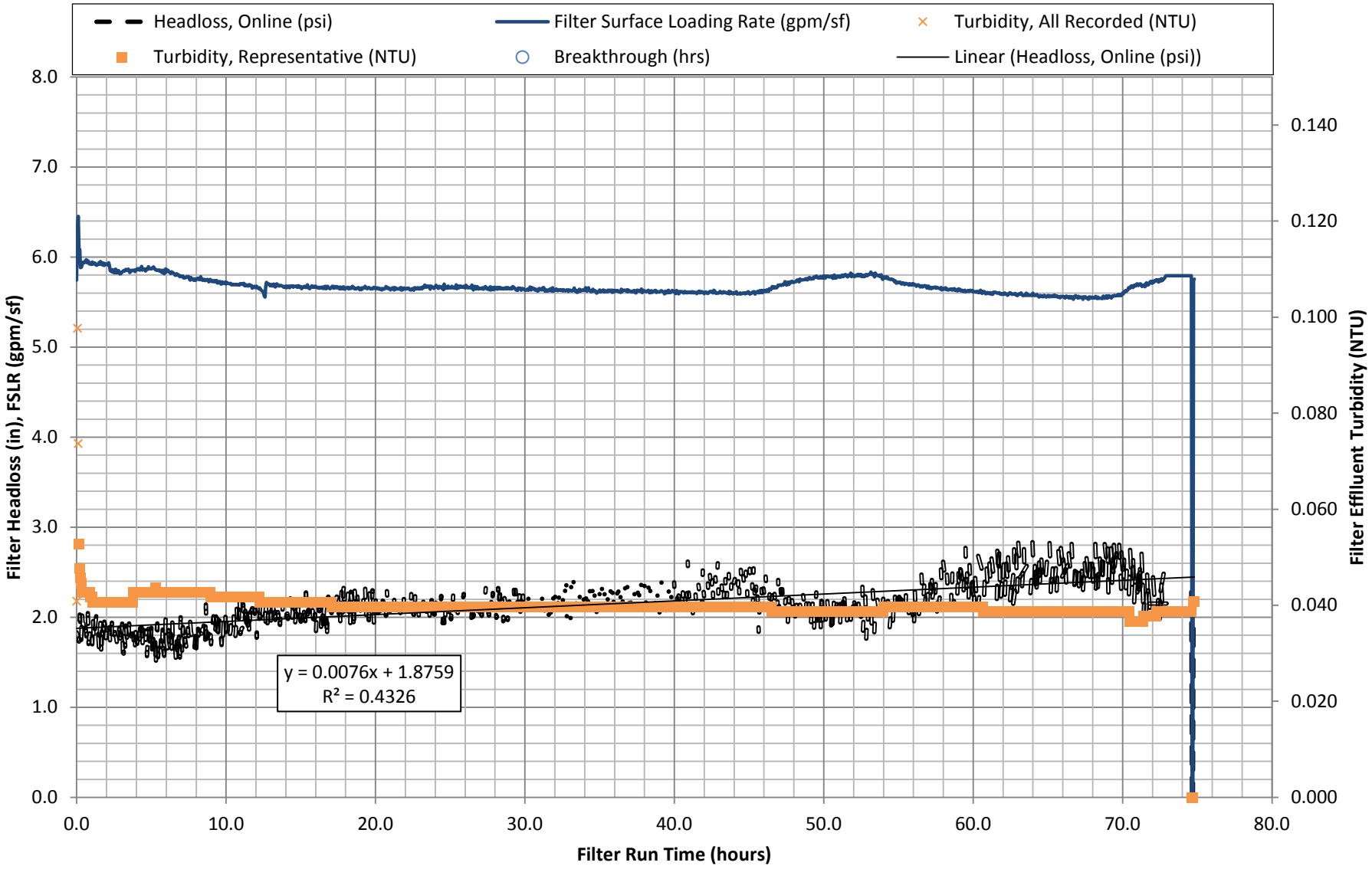


Figure C26: Filter B Operational Data
Trial 7 - July 28-31, 2017 (Wells 1 & 3)

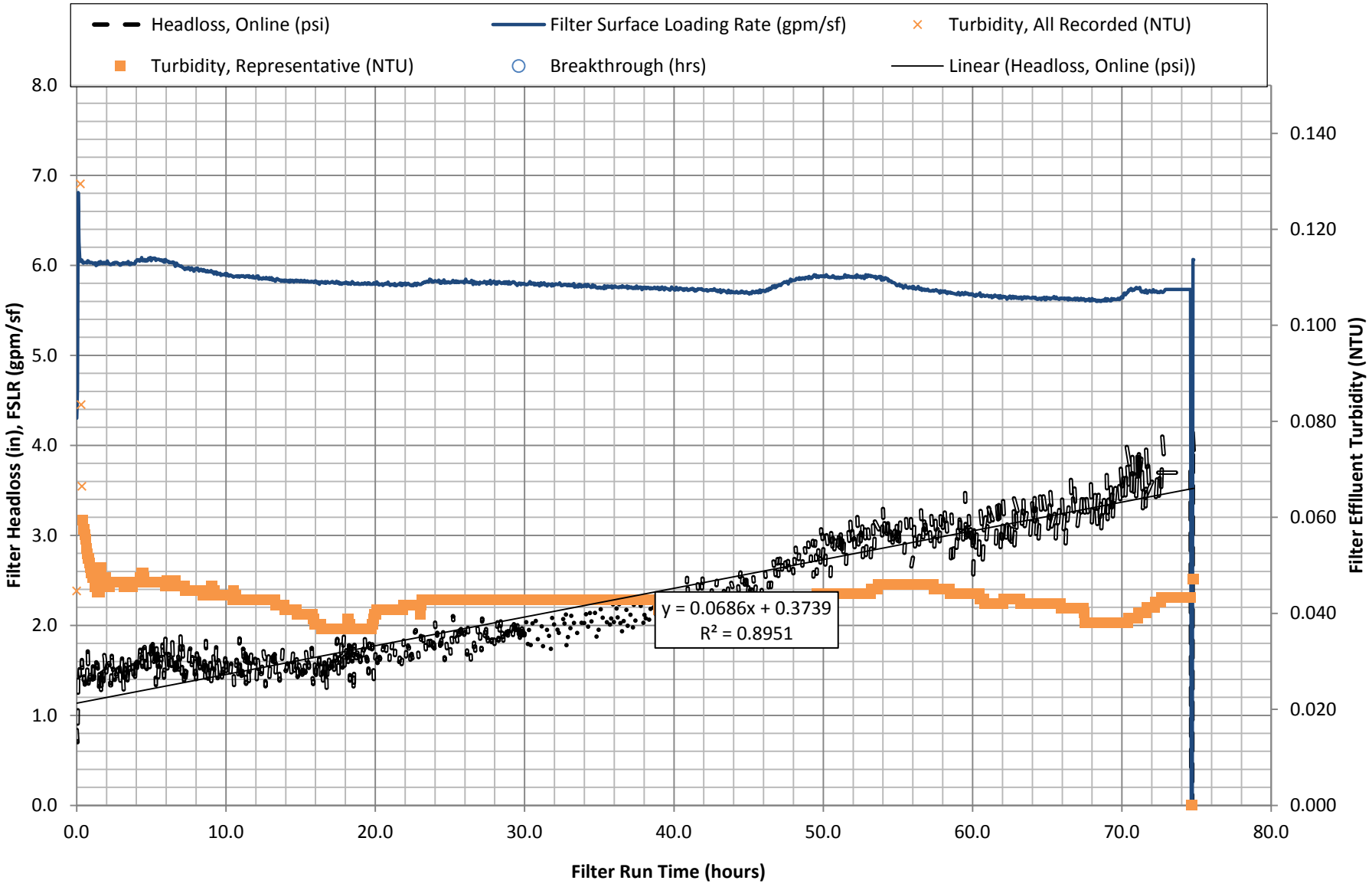


Figure C27: Filter C Operational Data
Trial 7 - July 28-31, 2017 (Wells 1 & 3)

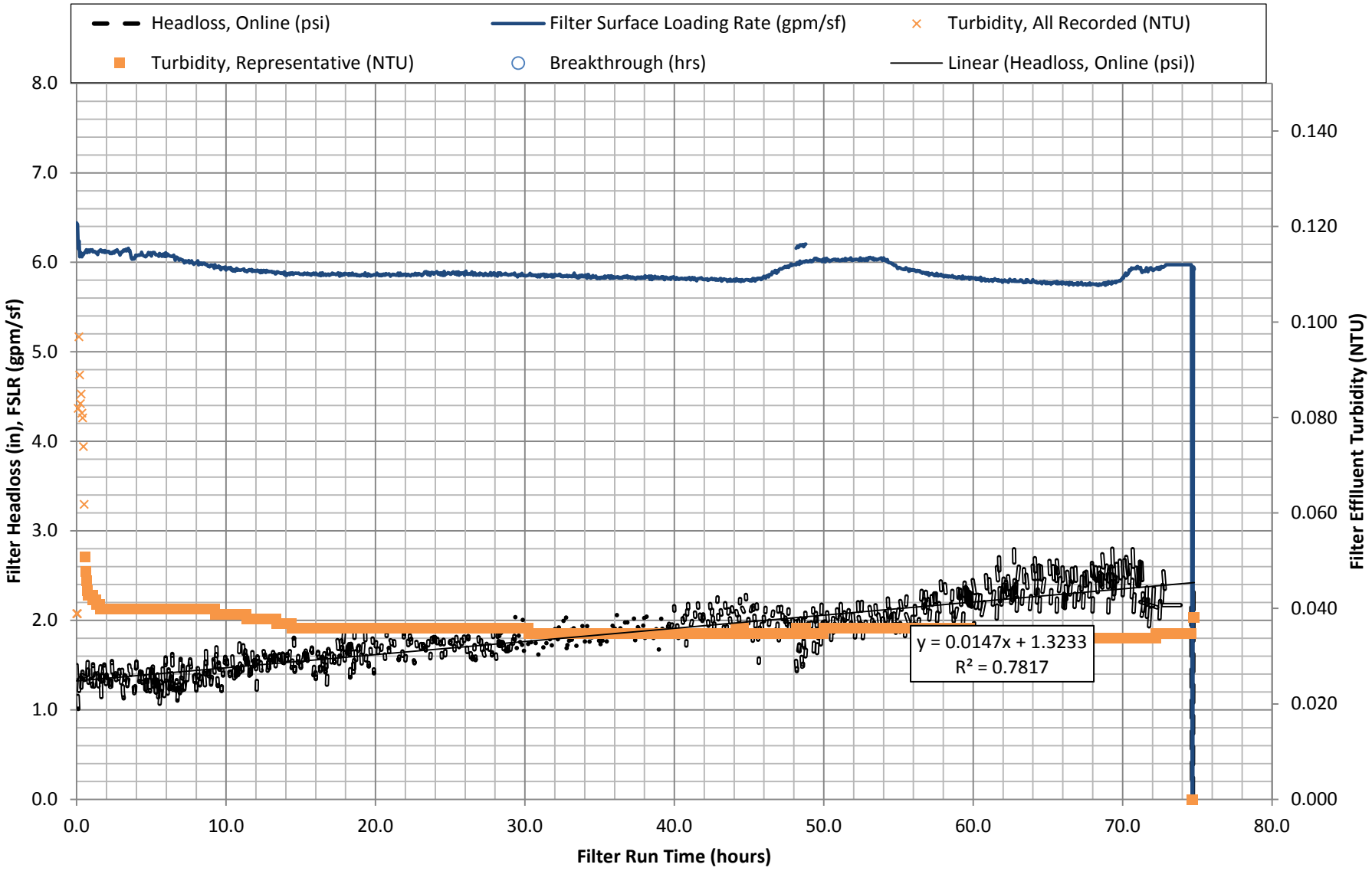


Figure C28: Filter D Operational Data
Trial 7 - July 28-31, 2017 (Wells 1 & 3)

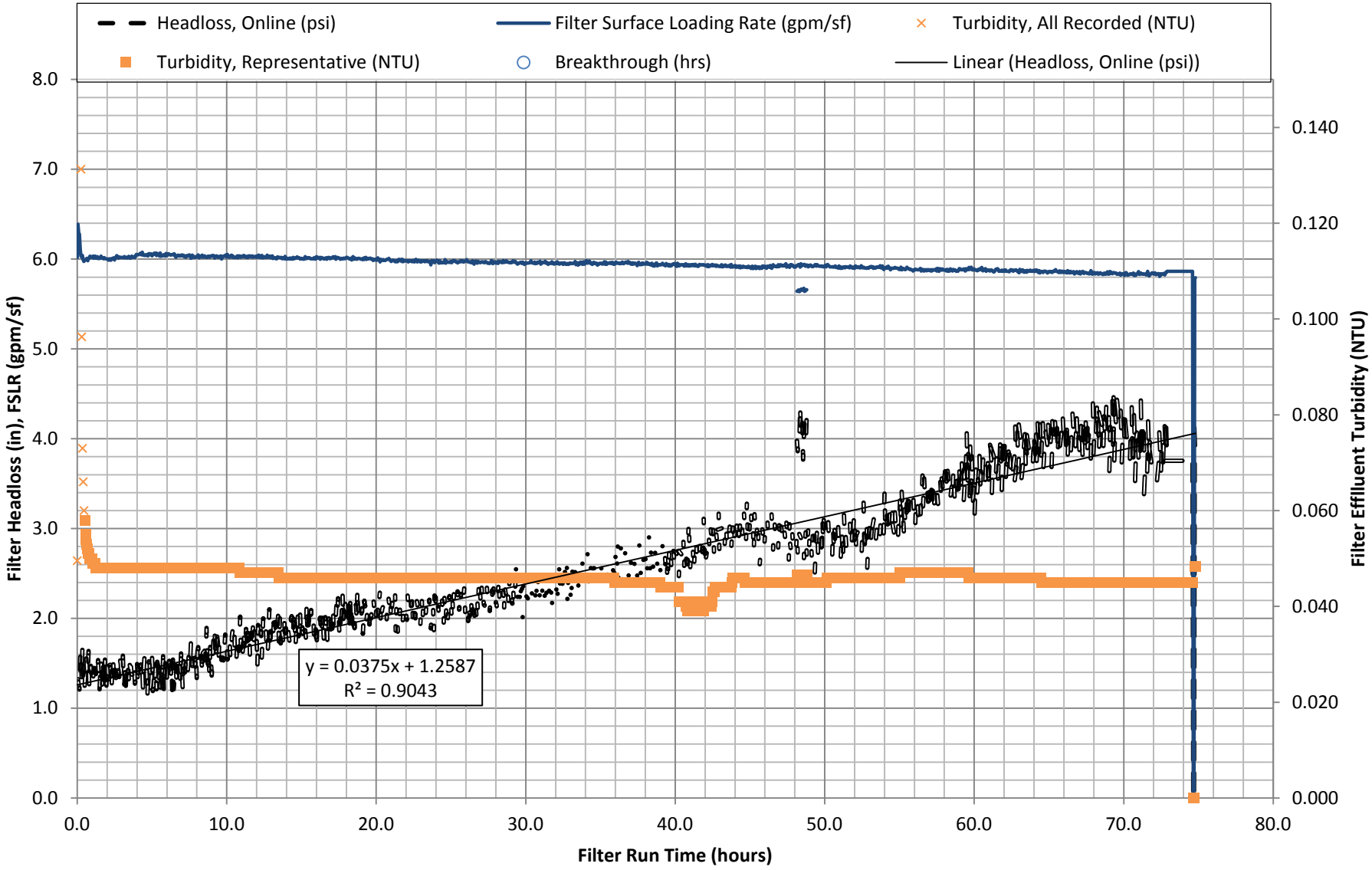


Figure C29: Filter A Operational Data
Trial 8 - July 31 - August 1, 2017 (Well 1 & 2)

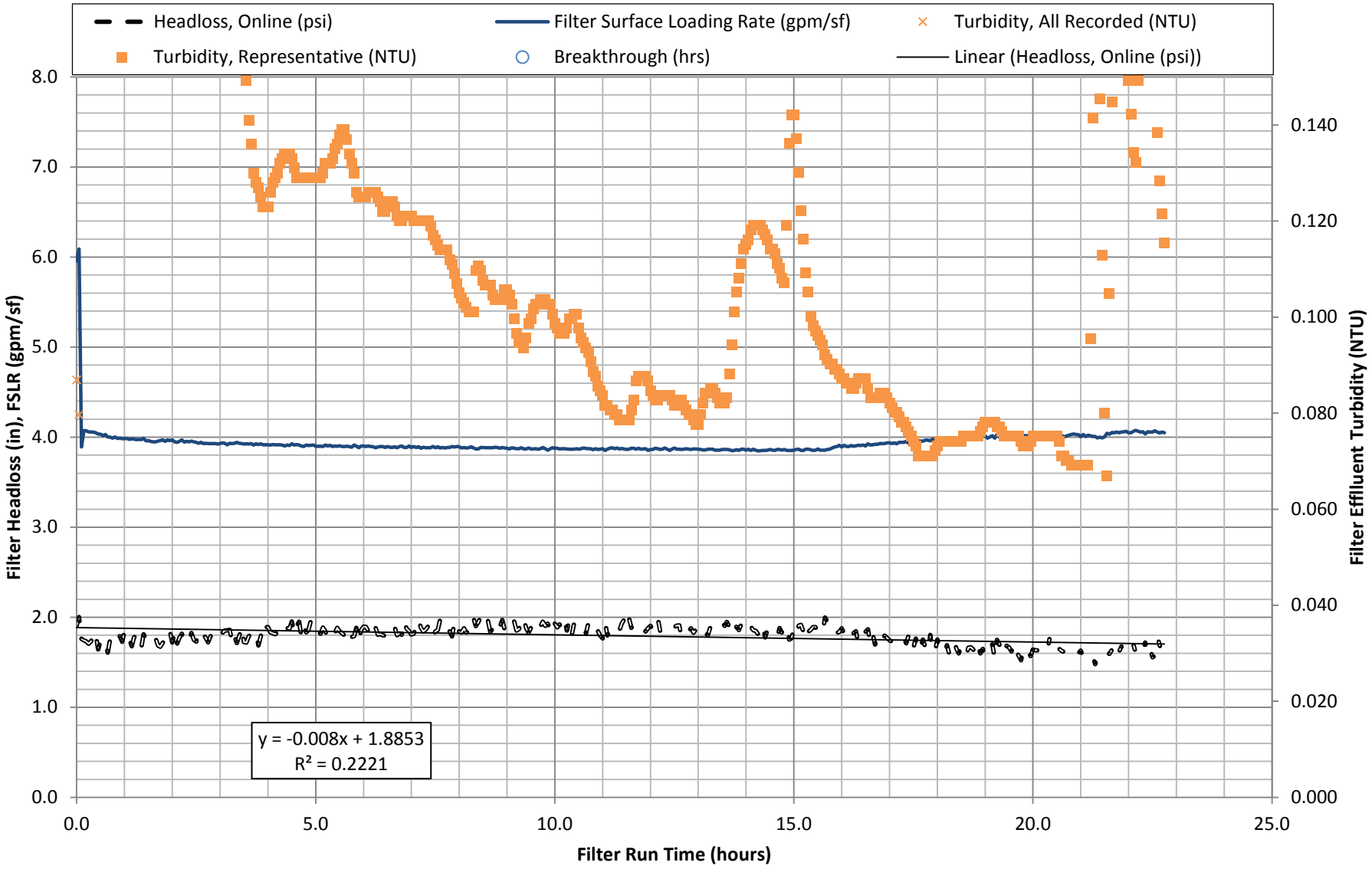


Figure C30: Filter B Operational Data
Trial 8 - July 31 - August 1, 2017 (Well 1 & 2)

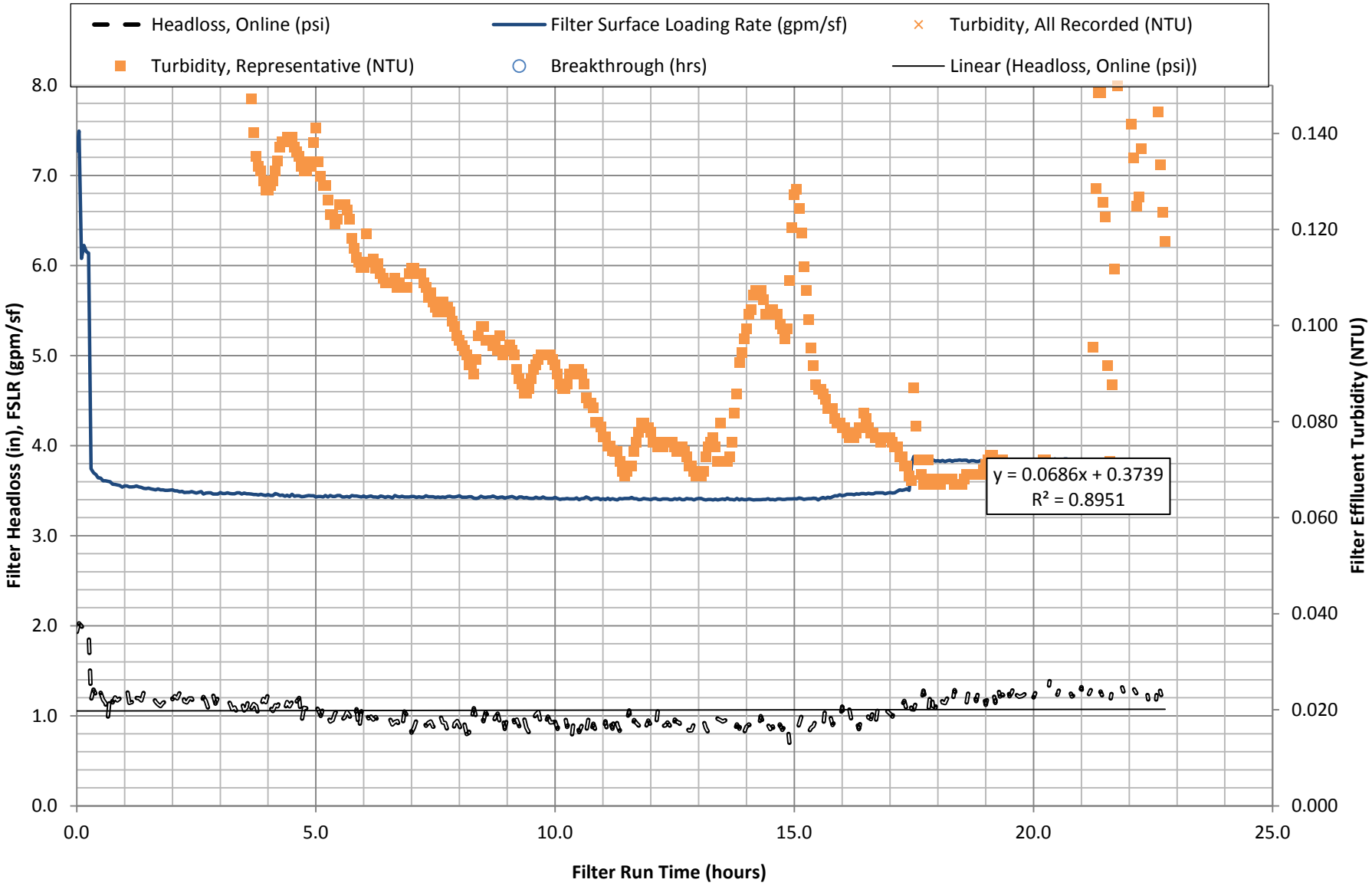


Figure C31: Filter C Operational Data
Trial 8 - July 31 - August 1, 2017 (Well 1 & 2)

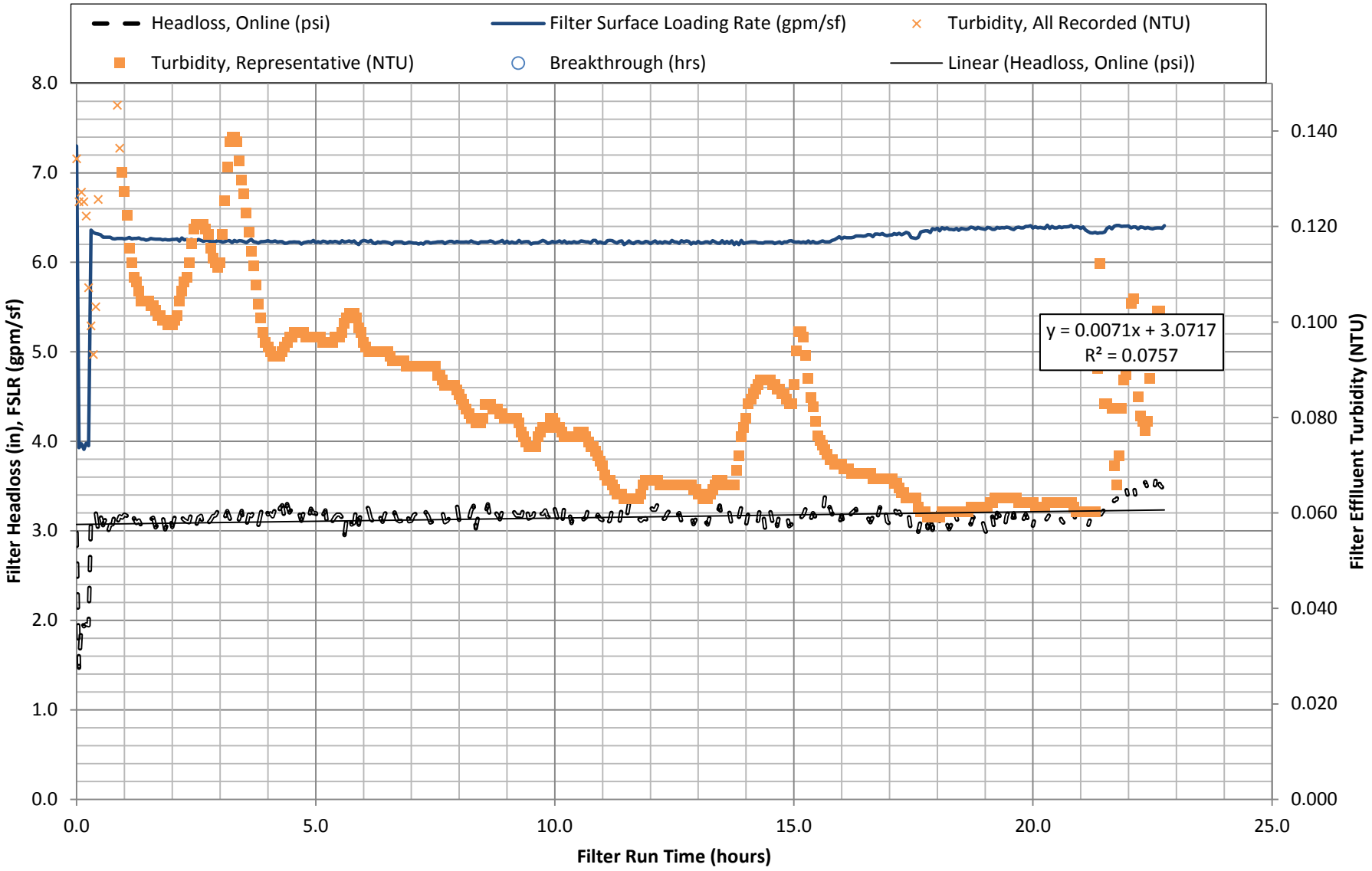


Figure C32: Filter D Operational Data
Trial 8 - July 31 - August 1, 2017 (Well 1 & 2)

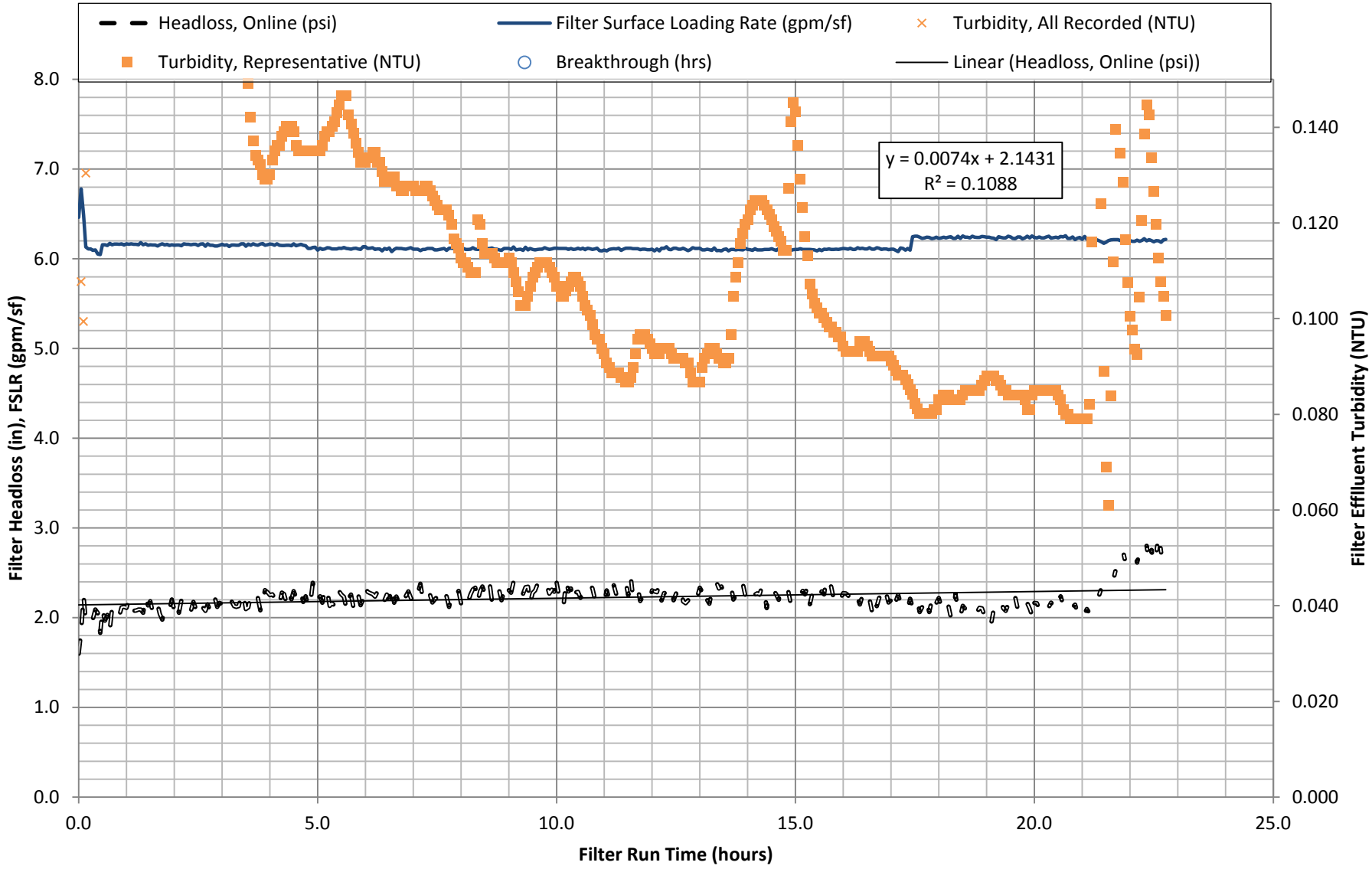


Figure C33: Filter A Operational Data
Trial 9 - August 1-4, 2017 (Well 1 & 2)

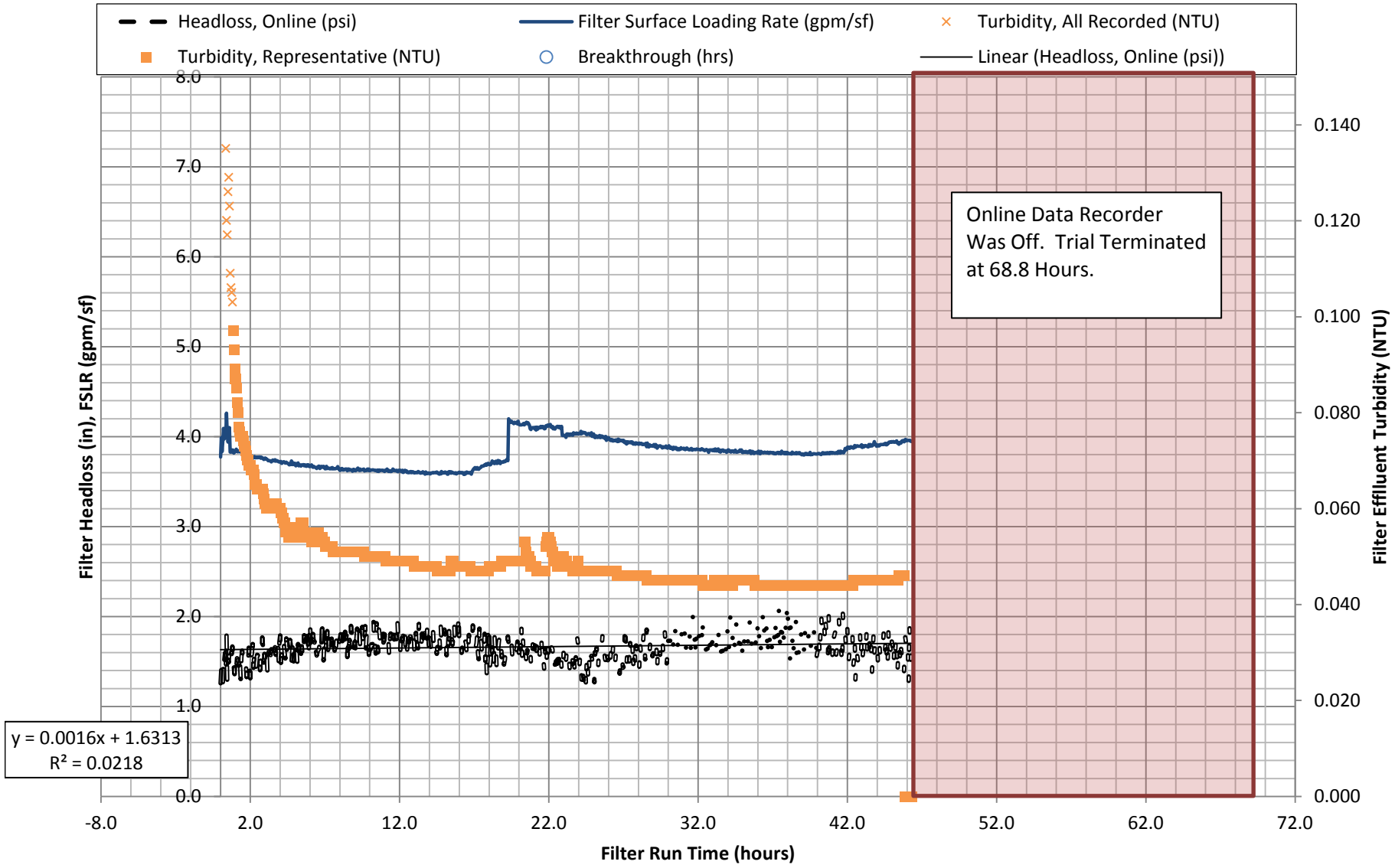


Figure C34: Filter B Operational Data
Trial 9 - August 1-4, 2017 (Well 1 & 2)

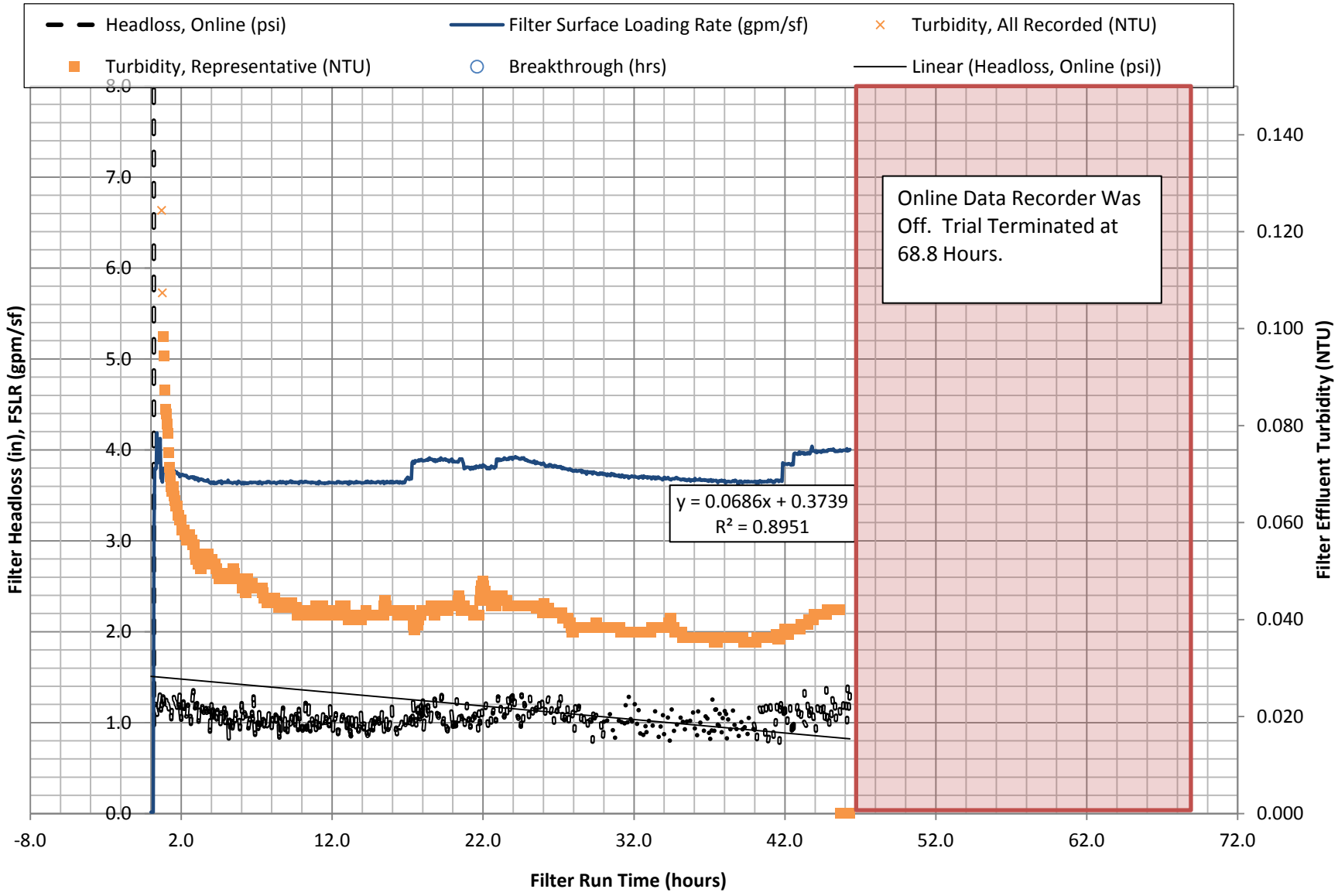


Figure C35: Filter C Operational Data
Trial 9 - August 1-4, 2017 (Well 1 & 2)

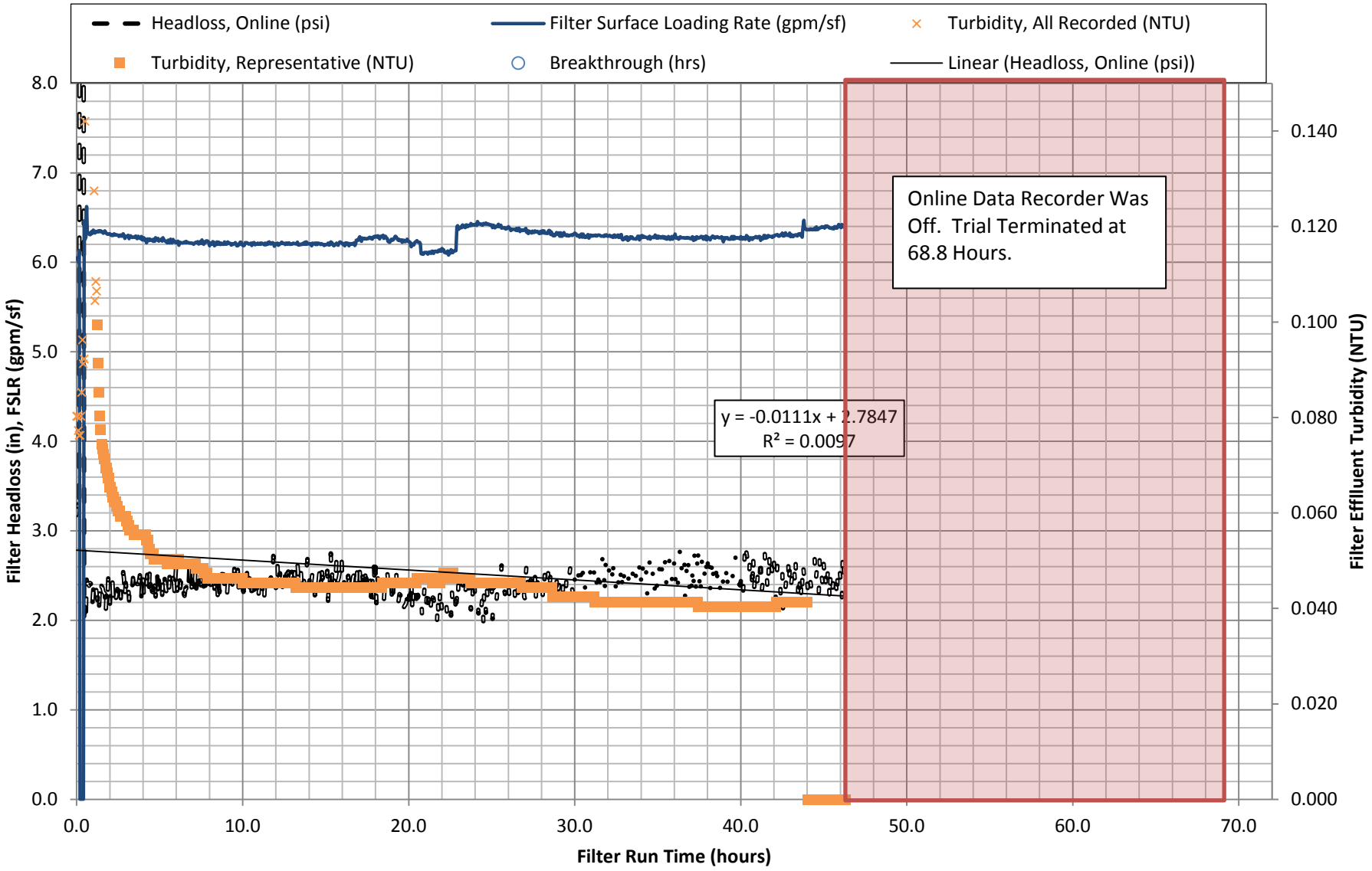
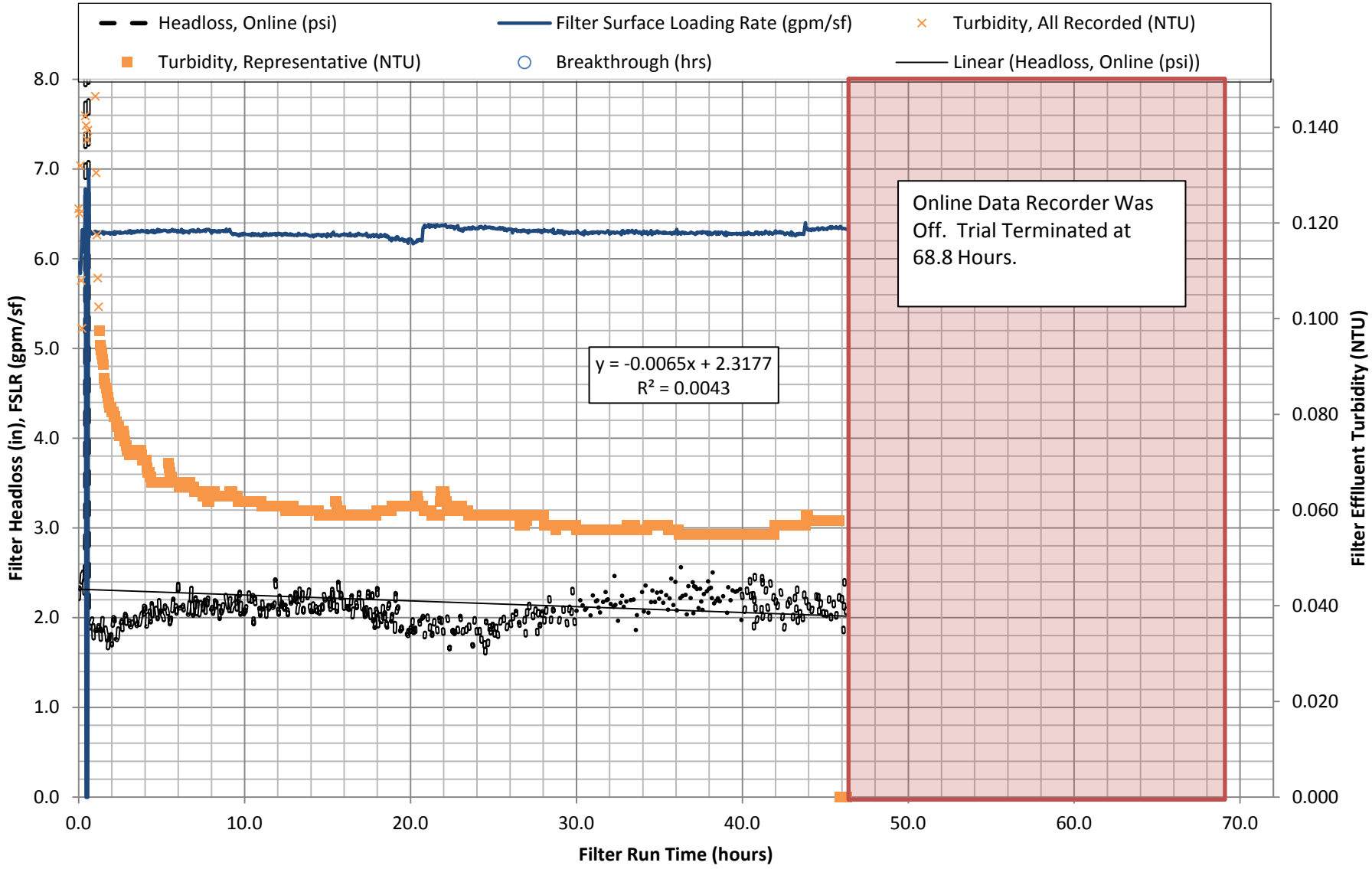


Figure C36: Filter D Operational Data
Trial 9 - August 1-4, 2017 (Well 1 & 2)



APPENDIX D – Calgon Filtrasorb 400 GAC

FILTRASORB® 400

Granular Activated Carbon

Applications

FILTRASORB 400 activated carbon can be used in a variety of liquid phase applications for the removal of dissolved organic compounds. FILTRASORB 400 has been successfully applied for over 40 years in applications such as drinking and process water purification, wastewater treatment, and food, pharmaceutical, and industrial purification.

Description

FILTRASORB 400 is a granular activated carbon for the removal of dissolved organic compounds from water and wastewater as well as industrial and food processing streams. These contaminants include taste and odor compounds, organic color, total organic carbon (TOC), and industrial organic compounds such as TCE and PCE.

This activated carbon is made from select grades of bituminous coal through a process known as reagglomeration to produce a high activity, durable, granular product capable of withstanding the abrasion associated with repeated backwashing, hydraulic transport, and reactivation for reuse. Activation is carefully controlled to produce a significant volume of both low and high energy pores for effective adsorption of a broad range of high and low molecular weight organic contaminants.

FILTRASORB 400 is formulated to comply with all the applicable provisions of the AWWA Standard for Granular Activated Carbon (B604) and Food Chemicals Codex. This product may also be certified to the requirements of ANSI/NSF Standard 61 for use in municipal water treatment facilities. Only products bearing the NSF Mark are certified to the NSF/ANSI 61 - Drinking Water System Components - Health Effects standard. Certified Products will bear the NSF Mark on packaging or documentation shipped with the product.

Features / Benefits

- Produced from a pulverized blend of high quality bituminous coals resulting in a consistent, high quality product.
- Carbon granules are uniformly activated through the whole granule, not just the outside, resulting in excellent adsorption properties and constant adsorption kinetics.
- The reagglomerated structure ensures proper wetting while also eliminating floating material.
- High mechanical strength relative to other raw materials, thereby reducing the generation of fines during backwashing and hydraulic transport.
- Carbon bed segregation is retained after repeated backwashing, ensuring the adsorption profile remains unchanged and therefore maximizing the bed life.
- Reagglomerated with a high abrasion resistance, which provides excellent reactivation performance.
- High density carbon resulting in a greater adsorption capacity per unit volume.

Specifications[1]	FILTRASORB 400
Iodine Number, mg/g	1000 (min)
Moisture by Weight	2% (max)
Effective Size	0.55–0.75 mm
Uniformity Coefficient	1.9 (max)
Abrasion Number	75 (min)
Screen Size by Weight, US Sieve Series	
On 12 mesh	5% (max)
Through 40 mesh	4% (max)

[1]Calgon Carbon test method

Typical Properties*	FILTRASORB 400
Apparent Density (tamped)	0.54 g/cc
Water Extractables	<1%
Non-Wettable	<1%

*For general information only, not to be used as purchase specifications.

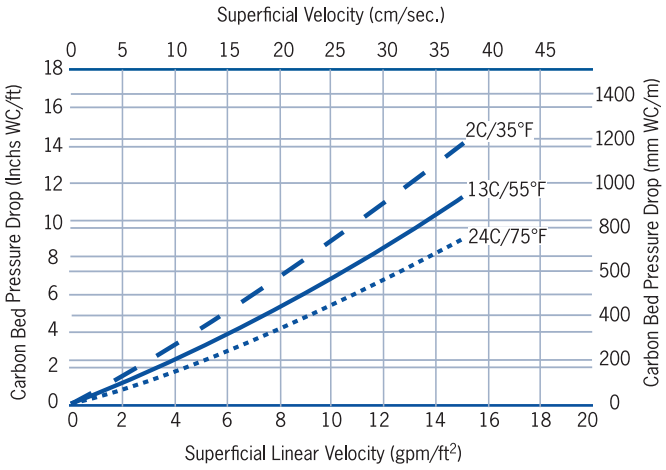
Safety Message

Wet activated carbon can deplete oxygen from air in enclosed spaces. If use in an enclosed space is required, procedures for work in an oxygen deficient environment should be followed.

DS-FILTRA40015-EIN-E1

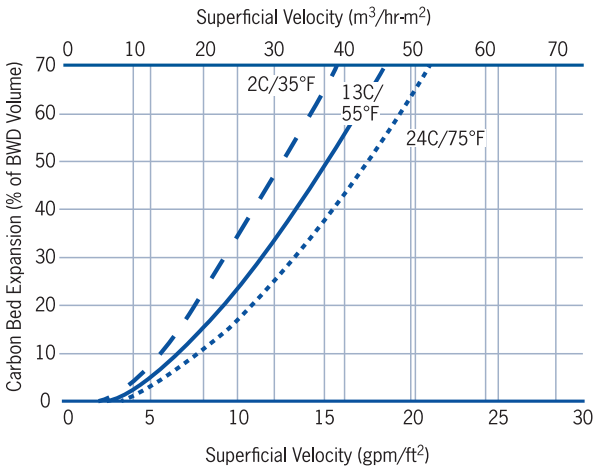
Typical Pressure Drop

Based on a backwashed and segregated bed



Typical Bed Expansion During Backwash

Based on a backwashed and segregated bed



Design Considerations

FILTRASORB 400 activated carbon is typically applied in down-flow packed-bed operations using either pressure or gravity systems. Design considerations for a treatment system is based on the user's operating conditions, the treatment objectives desired, and the chemical nature of the compound(s) being adsorbed.

Safety Message

Wet activated carbon can deplete oxygen from air in enclosed spaces. If use in an enclosed space is required, procedures for work in an oxygen deficient environment should be followed.

1.800.4CARBON calgoncarbon.com

DS-FILTRA40015-EIN-E1

APPENDIX E – Carus 1205

CARUS™ 1205

Water Treatment Chemical

CARUS™ 1205 water treatment chemical is an effective sequestering agent for use in potable water and industrial systems. The product is a liquid concentrate of exceptional purity, clarity, and stability. It is manufactured with the highest quality phosphates for better sequestration and corrosion control.

BENEFITS OF CARUS™ 1205 WATER TREATMENT CHEMICAL

- Controls iron and manganese, minimizing rusty or dirty water in the distribution system.
- Reduces discoloration, staining, and mineral build-up, resulting in fewer customer complaints.
- Diminishes calcium scale deposits typically seen in hot water lines and heaters.
- Lowers chlorine consumption, which controls biofilm regrowth and improves disinfection in the distribution system.
- Decreases iron tuberculation, which can extend the life of the distribution system.
- Minimizes the occurrence of microbial-influenced corrosion, providing longer system life.
- Saves money by reducing scale, lowering chlorine demand, and decreasing hydrant flushing, leaks, and failures.

PROPERTIES AND CERTIFICATIONS

- Clear liquid
- Do not freeze
- Best if used within one year
- NSF Maximum Feed Rate: 48 mg/L
- Specific Gravity: 1.28-1.34
- pH: 9.8 ± 0.5
- Weight: 10.5-11.0 lbs. per gallon
- Certified to ANSI/NSF Standard 60

SHIPPING AND HANDLING

CARUS™ 1205 water treatment chemical is packaged in 30- and 55-gallon containers and is also available in bulk quantities. The product is shipped in safety-sealed, food-grade containers or certified tankers. Each container is identified by a lot number. Avoid contact with eyes, skin, and clothing. For complete information, please refer to the Material Safety Data Sheet (MSDS).

APPLICATION

CARUS™ 1205 water treatment chemical is applied using a chemical metering pump. In most applications, the product is fed as a concentrate without the necessity of dilution. For dosage rates or answers to technical questions, please call Carus Phosphates, Inc. at (800) 929-67896.

Responsible Care®
Good Chemistry at Work

CARUS PHOSPHATES INC.
181 Woodlawn Ave • Belmont, NC 28012
Tel: (704) 822-1441 Fax: (704) 822-0922
E-Mail: salesmkt@caruscorporation.com
Web: www.caruscorporation.com

Form #PH
Rev. 10/07

Appendix D

TATA & HOWARD

Barnstable DPW Water Supply Division (Hyannis Water) UV-AOP Pilot Project

TrojanUVPhox™ 12AL30 Advanced Oxidation System

Pilot Test Report

November 27, 2017

TrojanUV - A Division of Trojan Technologies Group ULC
3020 Gore Road, London, Ontario, Canada N5V 4T7 T 519.457.3400 F 519.457.3030 www.trojanuv.com

1 INTRODUCTION

This document describes the work performed to demonstrate the ultraviolet/hydrogen peroxide (UV/H_2O_2) advanced oxidation process (AOP) for treating 1,4-dioxane present in the potable groundwater supply of the Barnstable DPW Water Supply Division (Hyannis Water) . The Barnstable water in Maher Wells 2 and 3 exceed the 0.3 ug/L limit set by the Massachusetts Office of Research and Standards Guideline Level (ORSGL).

The primary goal of the study was to demonstrate the ability of the UV/H_2O_2 process to treat 1,4-dioxane and provide the basis to determine the economic costs of implementing and maintaining a full-scale system. To facilitate these goals, TrojanUV has supplied and installed a small pilot-scale UV system (TrojanUVPhox™ 12AL30) with a hydrogen peroxide (H_2O_2) injection system. The tests were performed from August 7, 2017 through September 27, 2017.

This document provides a brief description of the procedures and results of these tests, based on values reported in the Blueleaf Inc. Barnstable pilot study report dated October 27, 2017.

2 UV-OXIDATION FUNDAMENTALS

2.1 TREATMENT MECHANISMS

UV-based advanced oxidation processes rely upon the simultaneous mechanisms of direct UV photolysis and UV oxidation to degrade chemical contaminants in water. UV-photolysis is the process by which chemical bonds of the contaminants are broken by the energy associated with UV light. UV-photolysis does *not* require the addition of H_2O_2. UV-Oxidation systems rely on the in-situ generation of hydroxyl radicals ($\bullet OH$) by way of the UV-photolysis of H_2O_2 and the subsequent oxidation of chemical contaminants by those hydroxyl radicals.

Hydrogen peroxide is commercially available as aqueous solutions of varying strength. The solutions most commonly employed in UV oxidation processes for water treatment are either 35% or 50% by weight and are certified to meet NSF/ANSI Standard 60 requirements. Hydrogen peroxide is a relatively weak absorber of UV light having a molar absorption coefficient at 254 nm of 19.6 L $mole^{-1}$ cm^{-1}. Nevertheless, the quantum yield of hydrogen peroxide UV photolysis is relatively high. Therefore, the UV/H_2O_2 process is one of the most efficient advanced oxidation processes.

Hydroxyl radicals are extremely reactive, short lived and unselective transient species. Therefore, the high reactivity and short life of these chemical species result in the requirement of in-situ generation of these oxidants. They will not exist beyond the boundaries of the UV reactor volume.

Hydroxyl radicals can oxidize organic and inorganic compounds by various types of reactions, comprising electron transfer reactions, hydrogen abstraction and electrophilic addition. In UV oxidation treatment processes the desired reactions are the oxidation of specific contaminant molecules.

2.2 WATER QUALITY PARAMETERS

2.2.1 UV Transmittance

UV transmittance (UVT) is the ratio of UV light transmitted through the sample to that transmitted through a reference solution. UVT is measured using a UV spectrophotometer. Reagent grade water is typically used as the reference solution (i.e., UVT = 100%). UV absorbance (A_λ) measures the amount of light absorbed by a solution over a given path length (l) and at a given wavelength (**λ**). UVT and UV absorbance are related by the following equation:

$$UVT=10^{-A\lambda}x100$$

The typical cell pathlength is 1 cm and both transmittance and absorbance values are commonly reported per cm. A key reference wavelength, and one at which UVT is often reported, is 254 nm. This wavelength is used because it is the wavelength at which a low pressure mercury UV lamp emits light. Transmittance decreases in the presence of UV absorbing substances and particles that either absorb or scatter UV light. This results in a reduction of available UV energy for disinfection and oxidation. The UV transmittance is the most important water quality parameter used in the sizing of a UV system. A UV system designer may compensate for low transmittance by increasing the residence time or the amount of equipment.

2.2.2 Hydroxyl Radical Scavenging Demand

While the desired reaction in UV oxidation systems is between photogenerated hydroxyl radicals and contaminant molecules the unselective nature of hydroxyl radical reactions result in reaction pathways that consume hydroxyl radicals by reaction with constituents of the background water matrix. Examples of these hydroxyl radical scavenging reactions are the oxidation reactions with the natural organic matter (NOM) present in natural waters or reactions with carbonate and/or bicarbonate ions. Hydrogen peroxide itself will react with hydroxyl radicals and, therefore, is considered a hydroxyl radical scavenger. All of these scavenging reactions have the effect of reducing the steady state concentration of hydroxyl radicals in the water. Since the rate of contaminant degradation is proportional to the steady state concentration of hydroxyl radicals, these hydroxyl radical scavenging reactions reduce the rate of contaminant degradation. The level of scavenging reactions associated with a water sample can be quantified and is referred to as the hydroxyl radical scavenging demand of the water. Trojan routinely determines the scavenging demand of water samples at its laboratory in London, Ontario.

2.3 THE ELECTRICAL ENERGY PER ORDER PARAMETER

In sizing UV systems for Environmental Contaminant Treatment, a different metric is used than for UV systems for disinfection. This metric is called Electrical Energy per Order, or E_{EO} (Bolton et al. 1996).

E_{EO} is the electrical energy (measured line power draw) required to reduce the contaminant concentration by one order of magnitude (one log, or 90%) in one cubic meter (m^3) or 1000 gallons (kgal) of water (depending on the choice of flow units). Typical units are:

$$\left(\frac{kWh}{kgal \bullet order}\right) \text{ or } \left(\frac{kWh}{m^3 \bullet order}\right).$$

E_{EO} is a reactor, contaminant, and water-quality specific metric and the figure of merit accepted by the Photochemistry Commission of the International Union of Pure and Applied Chemistry for UV-photolysis/UV-oxidation technologies. It is a measure of the efficiency with which a given contaminant is treated by UV-photolysis and UV-oxidation. Different contaminants will have different E_{EO} values in the same UV reactor in water with the same water quality. Different reactors will have different E_{EO} values as the term measures a UV reactor's hydraulic, optical and electrical efficiency (when comparing two reactors treating the same contaminant under the same conditions). E_{EO} is directly proportional to the required power draw: the lower the E_{EO}, the lower the power required by the system. The following formula can be used to compute the E_{EO} of a UV treatment system in units of kWh/kgal/order with flow in gallons per minute (gpm) and power draw in kilowatts (kW):

$$E_{EO}\left(\frac{kWh}{kgal \bullet order}\right) = \frac{measured\ reactor\ power\ draw\,(kW)}{flowrate\,(gpm) \times 0.06 \times \log\left(\frac{C_o}{C}\right)}$$

Where

- 0.06 is a conversion factor that converts minutes to hours and normalizes the flow rate on a 1000-gallon basis
- C_o is the concentration of contaminant at the influent of the reactor
- C_f is the concentration of contaminant at the effluent of the reactor

In general, the energy required to reduce the contaminant initially by 90% is the same as the energy required to treat 90% of the remaining contaminant, for a total of 99% reduction (log-linear kinetics). In other words, the same energy is needed to reduce 100 units of contaminant to 10 units of contaminant as is needed to reduce 10 units of contaminant to 1 unit of contaminant.

A related term to E_{EO} is the electrical energy dose (EED) which is determined by dividing the system power draw (kW) by the flow rate. Typical units of EED are kWh/kgal or kWh/m^3.

2.3.1 Parameters affecting E_{EO}

- Reactor design. Different reactors (even those using the same type of lamp) can have significantly different E_{EO} values for a given water and contaminant. This is due to reactor characteristics such as lamp spacing, lamp orientation, and location of influent/effluent ports. Therefore, E_{EO} is a reactor-specific measure. The implications of this are that project specifications cannot specify design E_{EO} values as they will differ from UV system to UV system.
- Reactor Lamp Type. Properties of the lamp such as UVC power conversion efficiency and emittance spectrum can have a significant impact on E_{EO}.
- Water quality. Water quality parameters that impact E_{EO} are:
  - UV transmittance (UVT): E_{EO} increases as UVT decreases. That is, as the water becomes less transmissive to UV light, more power is required to achieve a desired log reduction in the contaminant concentration.

  - Hydroxyl radical scavenging demand: E_{EO} increases as the hydroxyl radical scavenging demand of the water increases. That is, with greater competition for hydroxyl radicals due to the water matrix, fewer radicals are available to react with the contaminant.

  These water quality parameters impact various reactors and lamp types differently.
- Lamp age. E_{EO} increases as lamps age. That is, more power is required at the end of the lamp life than at the beginning in order to achieve the same effectiveness. This is because the lamp's UVC electrical efficiency decreases over time.
- Flow rate. In general, because E_{EO} is normalized by the flow rate, reactor systems treating different flow rates can be compared. However, such comparisons should be made cautiously as empirical evidence and theoretical analysis have shown that the E_{EO} value decreases to an asymptotic value as flow rate increases. This is due to increases in reactor hydraulic efficiency with increases in turbulence and mixing at higher flow rates. Reactors must be specifically designed for certain conditions, including flow rates.
- Hydrogen Peroxide Concentration. E_{EO} is a strong function of H_2O_2 concentration. The irradiation of H_2O_2 produces hydroxyl radicals which accelerate the degradation of contaminants in the water. The higher the H_2O_2 concentration the more UV it absorbs and the more radicals are formed. However, H_2O_2 itself scavenges hydroxyl radicals. Therefore, the greater the concentration of H_2O_2, the greater the scavenging of hydroxyl radicals. Therefore, E_{EO} varies inversely with H_2O_2 concentration but this is not a linear relationship.
- Contaminant. Different contaminants will have a different E_{EO} value in the same reactor in water with the same quality. This is due to differences in the quantum yield, molar absorption coefficient, and hydroxyl radical reaction rate (i.e., their fundamental kinetic parameters).

3 UV-AOP PILOT SYSTEM DESCRIPTION

The UV-AOP system supplied by Trojan for this project was the TrojanUVPhox™ 12AL30. The system, manufactured by TrojanUV, utilizes 12 low-pressure high output (LPHO) lamps that are mounted horizontally, parallel to the flow path. The system is equipped with dimmable electronic ballasts (power supplies for the UV lamps) that can be adjusted from 60 to 100 percent of full power output in 2-percent increments, which enables efficient power adjustment to meet changing wastewater quality and flow.

The UV reactor provided was mounted on a test skid that also contained the Optiview online UVT meter, system control center (SCC) with a user interface, a 3" magnetic flow meter, and related influent/effluent 6" piping. A drawing of the system is provided in Figure 1. The test system also included a H_2O_2 storage tank and an injection pump.

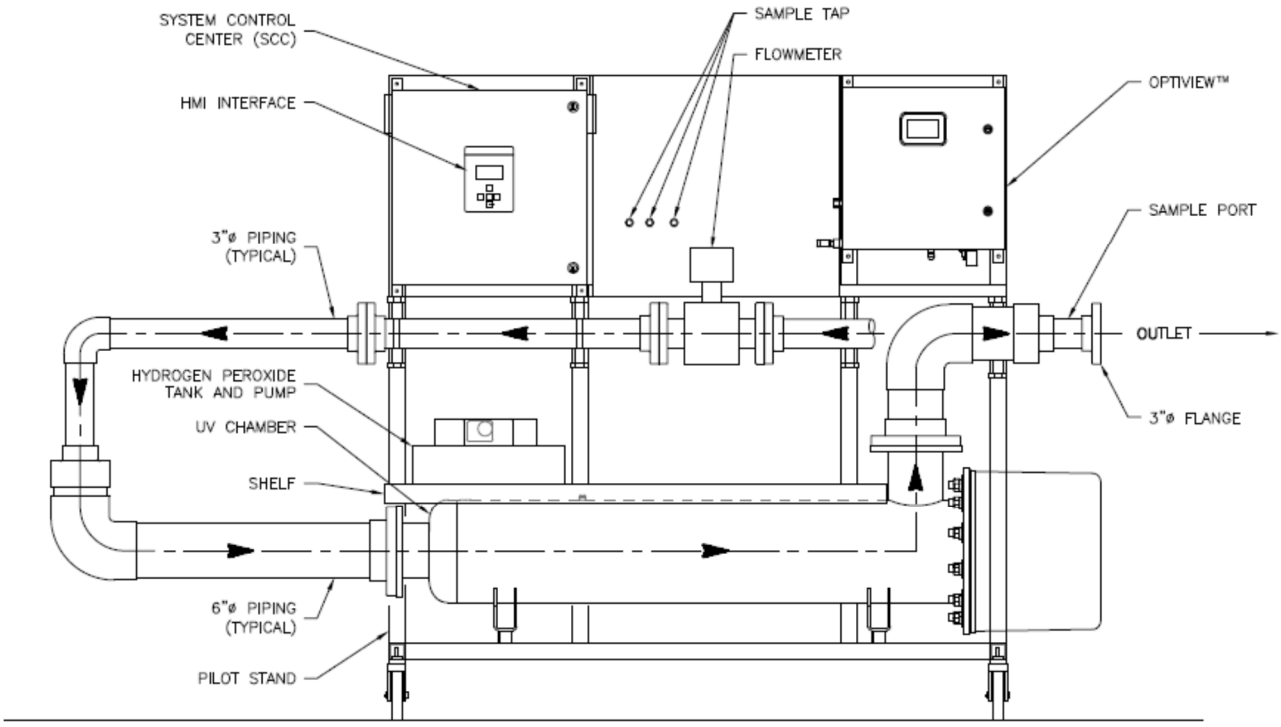


Figure 1: Drawing of the TrojanUVPhox™ 12AL30 UV system test skid.

4 UV-AOP SYSTEM TEST PROCEDURES

4.1 UV-AOP TEST PROCEDURE

The pilot test was conducted by Blueleaf Inc. Specific procedures followed can be found in the Blueleaf test report titled, "PILOT STUDY REPORT FOR IRON AND MANGANESE REMOVAL BY PRESSURE FILTRATION 1,4 DIOXANE REMOVAL BY ADVANCED OXIDATION WITH UV PFOS/PFOA REMOVAL BY ADSORPTION WITH GAC CONTACTORS COMPLETED AT TOWN OF BARNSTABLE DPW WATER SUPPLY DIVISION MAHER WELLS, BARNSTABLE, MA JULY-SEP 2017".

4.2 SAMPLE HANDLING AND ANALYSIS

4.2.1 UV Transmittance

UVT for this project was measured using a Trojan Optiview™ online analyzer. The Optiview was equipped with a continuously fed UV influent sample line. The instrument measured UVT at 254nm, and sent a signal to the system PLC for continuous data collection during the course of the study.

4.2.2 Hydroxyl Radical Scavenging Demand

For this project, three separate samples were sent to Trojan's laboratory in London, Ontario for determination of scavenging demand. This analysis involves spiking the sample with a surrogate compound and hydrogen peroxide, and exposing the sample to accurate doses of UV light using a collimated beam (CB) apparatus. The spiked compound competes for the hydroxyl radical with the background constituents in the sample, so that the amount of surrogate compound destruction varies inversely with the scavenging demand of the water.

4.2.3 Hydrogen Peroxide

Hydrogen peroxide was determined by Blueleaf using a CHEMetrics Hydrogen Peroxide CHEMets® Kit. To complete this analysis, a CHEMet ampule containing reagent is mixed with 25 mL sample. The sample is mixed, and a 30 second reaction time begins. Hydrogen peroxide is determined from the generation of an orange color, and the use of a color comparator standard.

4.2.4 1,4-dioxane

1,4-dioxane in the UV influent and effluent was determined by Alpha Analytical (Westborough, MA) using EPA method 522.

4.2.5 Quartz Sleeve Fouling

To provide a general assessment of quartz sleeve fouling, a used sleeve that was in the reactor for the duration of the pilot, was removed, rinsed with clean water, dried, and shipped to Trojan for analysis. A Varian (Agilent) Cary 50 spectrophotmeter with a custom sleeve holder was used for the measurements. The instrument is checked routinely for accuracy with NIST traceable UV absorbance standards (Starna Cells Inc., Atascadera, CA). Both the used sleeve and a new sleeve were measured at 30 different locations along the sleeve, and the square root of the sleeve UVT was calculated to represent the single-wall UVT. The sleeve fouling factor (FF) was calculated as follows:

$$FF = \frac{pilot\ sleeve\ single\ wall\ UVT}{reference\ sleeve\ single\ wall\ UVT}$$

5 RESULTS AND DISCUSSION

5.1.1 Water Quality

Table 1 lists the water quality results for the samples sent to Trojan. All three samples had similar water quality characteristics. Of greatest importance is that all samples had low hydroxyl radical scavenging demand, which is favourable for UV-AOP.

UV absorbance spectra of the samples are shown in Figure 2. All three samples had a low absorbance in the 200-300nm range, with UVT values of 98-99% (254nm, 1/cm).

Table 2 lists the water quality results as reported by Blueleaf. The alkalinity is low in every sample (under 16 mg/L). This is ideal for the UV-AOP process, as bicarbonate and carbonate ions are hydroxyl radical scavengers so would inhibit treatment of the 1,4-dioxane if present at high concentrations.

Total iron and manganese are also low, with maximum values of 0.12 and 0.053 mg/L, respectively. These metals are generally associated with fouling of the quartz UV lamp sleeves, so their relative absence is favourable for the use of UV.

Table 1: Pilot results for water quality, as analyzed by Trojan.

Sample Date	Trojan Sample ID	Sample Description	pH	Alkalinity (mg/L)	UVT_{254nm} (%, 1/cm)	Nitrate (mg/L)	Scavenging Assessment
04/08/2017	905	Raw water blend Well	6.00	13.8	98.9	1.4	Low
24/08/2017	912	Raw water from Well I	5.99	12	98.2	1.5	Low
07/09/2017	922	Raw water blend from	6.16	12.7	97.9	1.6	Low

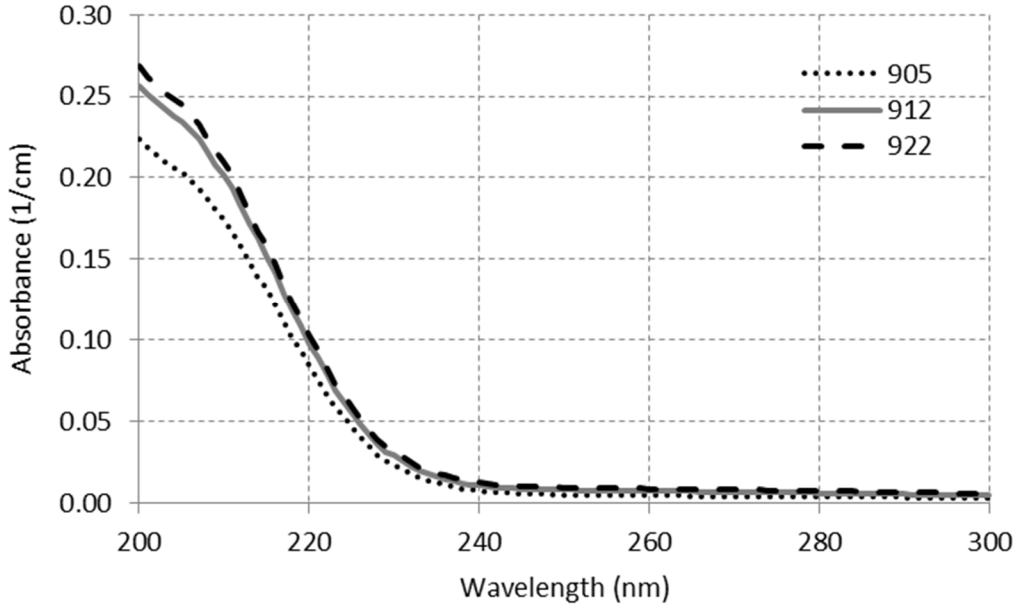


Figure 2: UV absorbance spectra of water samples submitted to Trojan.

Table 2: Water quality results relevant to UV, as reported by Blueleaf.

Date	Total Iron (mg/L)	Total Mn (mg/L)	Total Alkalinity (mg/L)	UVT_{254nm} (%, 1/cm)
08/07/2017	0.081	0.053	15.2	99.8
08/11/2017	0.057	0.05	14.4	99.8
08/18/2017	0.072	0.05	13.1	99.8
08/23/2017	0.082	0.053	13.1	99.8
08/30/2017	0.086	0.051	13.8	99.8
09/06/2017	0.085	0.041	13.2	99.7
09/13/2017	0.12	0.048	13.2	99.7
09/20/2017	0.09	0.05	13.5	99.7
09/27/2017	0.092	0.049	13.0	99.7

5.1.2 Quartz Sleeve Fouling

The fouling factor calculated using the pilot sleeve and new sleeve is 0.94. The Carollo Engineers third party approved sleeve fouling factor is 0.95, so the pilot result is very similar. However, it should be noted that the pilot fouling result is likely biased low due to a number of reasons. These include the small sample size (n=1) for both the pilot sleeve and new sleeve, the inherent variability in UVT that exists in the new sleeve measurements due to manufacturing, and the absence of a UVT measurement for the specific pilot sleeve prior to installation in the pilot. It is likely that the pilot fouling result should have been greater than 0.95, since the third party fouling test was conducted in poorer water quality (secondary wastewater effluent). Regardless, the full scale UV system sizing recommendations allow for uncertainty in parameters such as sleeve fouling.

5.1.3 1,4-dioxane Treatment

Test conditions and results for 1,4-dioxane, are found in Table 3 (as reported by Blueleaf). Hydrogen peroxide values were also provided, although most influent values are only available as whole numbers, suggesting semi-quantitative results. The 1,4-dioxane in the influent samples ranged from 0.152 to 0.661 ug/L. All effluent samples were well below the regulatory limit of 0.3 ug/L. These values were also below the laboratory method detection limit of 0.144-0.147 ug/L. Since the UV effluent samples were below detection, the actual log inactivation values cannot be determined.

The (minimum) 1,4-dioxane log reduction values are plotted for each sample event in Figure 3. The 09/13/17 result appears as an outlier. This is due to the low influent 1,4-dioxane concentration and its proximity to the method detection limit.

Table 3: Pilot results for 1,4-dioxane treatment. All tests were completed at 20 gpm and 99.7-99.8%UVT.

Date	BPL (%)	H2O2-Inf (mg/L)	H2O2-Eff (mg/L)	1,4-Dioxane Inf (ug/L)	1,4-Dioxane Eff(ug/L)*	Measured 1,4-Dioxane Log Reduction	Predicted 1,4-Dioxane Log Reduction
08/07/2017	100	--	--	0.594	<.144	>0.62	--
08/11/2017	100	5	1.5	0.661	<.144	>0.66	3.6
08/18/2017	100	5	1	0.518	<.144	>0.56	3.6
08/23/2017	100	3	2	0.553	<.147	>0.58	2.4
08/30/2017	100	2.5	2.5	0.461	<.147	>0.50	2.0
09/06/2017	60	5	2	0.407	<.144	>0.45	1.7
09/13/2017	60	1	0.9	0.152	<.147	>0.01	0.4
09/20/2017	60	1	0.8	0.412	<.147	>0.45	0.4
09/27/2017	60	1	0.5	0.403	<.144	>0.45	0.4

*all effluent samples were below the laboratory method detection limit

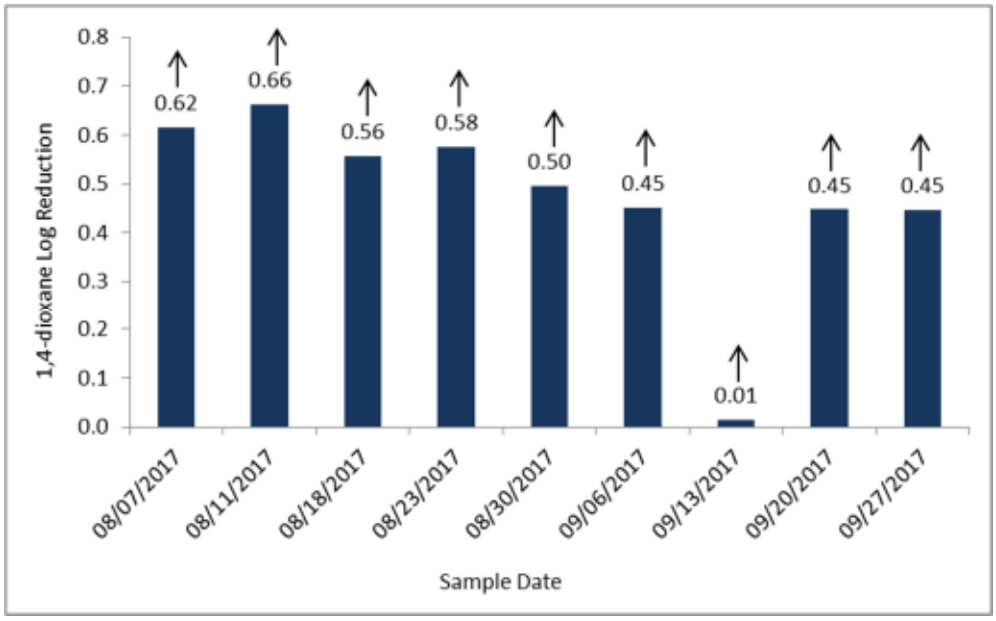


Figure 3: Minimum measured log reduction values of 1,4-dioxane for each pilot test.

5.1.4 Full Scale UV –AOP system sizing

Based on the results of the Blueleaf test effort, a full scale UV system sizing recommendation can be made. Water quality results have shown a low hydroxyl scavenging demand and high UVT. Based the design conditions of 0.5 log inactivation of 1,4-dioxane (0.8 to <0.3 ug/L), 98% UVT, and 1500 gpm, two trains of TrojanUVPhox™ 30AL50 (one duty reactor per train) operating with 4.5 mg/L hydrogen peroxide would be required. Alternatively, one train of one TrojanUVPhox™ 72AL75 could be used with 3.5 mg/L hydrogen peroxide.

6 CONCLUSIONS

The data generated from operating a TrojanUVPhox™ 12AL30 pilot-scale UV reactor together with H_2O_2 injection has demonstrated that the UV/H_2O_2 AOP is effective at treating 1,4-dioxane in the Barnstable well water. Specifically,

- Three water samples demonstrated high UV transmittance and low hydroxyl radical scavenging, making Barnstable a very good candidate for UV/H_2O_2 AOP treatment.
- All pilot UV effluent samples were not only below the 0.3 ug/L regulatory limit, but also below the third party laboratory method detection limit.
- The measured quartz sleeve fouling factor for the limited data set (n=1) was 0.94.
- These results provide confidence in full scale sizing, which for 98% UVT, 1500 gpm, and a 1,4-dioxane log reduction target of 0.5, would require two trains of TrojanUVPhox™ 30AL50 (one duty reactor per 750gpm train) operating with 4.5 mg/L hydrogen peroxide.
- As an alternate sizing option, one train of one TrojanUVPhox™ 72AL75 could be used with 3.5 mg/L hydrogen peroxide.

Appendix E

TATA & HOWARD

Blueleaf Incorporated
PILOT TESTING FOR WATER AND WASTEWATER TREATMENT
57 DRESSER HILL ROAD
CHARLTON, MA 01507
(508) 248-7094 OFFICE
(508) 248-1650 FAX

November 30, 2017

Mr. Jon Gregory, P.E.
Tata and Howard, Inc.
10 Riverside Drive, Suite 204
Lakeville, MA 02347

Re : Results of Additional 1,4 Dioxane Testing at Hyannis Water in Barnstable, MA

Mr. Gregory,

This report summarizes the methods and results of the additional 1,4 dioxane testing conducted at Hyannis Water in Barnstable, MA. This testing was conducted during October and November 2017 after conclusion of the comprehensive pilot study to evaluate removal technologies for iron, manganese, 1,4 dioxane, PFOS and PFOA. The additional testing evaluated 1,4 dioxane removal from raw water when treated directly by the GAC contactors intended for PFOS/PFOA removal.

Description of Pilot Equipment

The pilot scale filter column used for the testing consisted of a single 6" diameter pipe, 90" in length, containing 36-inches of virgin Filtrasorb 400 granular activated carbon (GAC) filter media. The Filtrasorb 400 media is the same GAC utilized during the comprehensive pilot for PFOS/PFOA removal.

Raw water was supplied to the pilot filter in the same manner as the comprehensive study. Water was supplied from Wells 1 and 2 via above ground piping to a blending tank, where

the flows were combined in a 50/50 blend. Flow control valves in combination with rotometers allowed the operator to control the flow rates to the blending tank. Blended raw water was supplied to the GAC contactor by a ½ HP booster style feed pump to provide adequate and consistent pressure. The feed pump suction was connected to the blended water tank with ¾" nylobraid tubing. The water was pumped to the contactor and was regulated by a rotameter and manual control valve. Flow entered the top of the column and the contactor operated with downward flow.

Figure 1: Pilot Scale GAC Contactor and Blending Tank

Method

The GAC contactor was constructed at the site on October 6, 2017 and started up. It was discovered that the incorrect GAC type was installed in the contactor. The GAC was

replaced with the proper GAC on October 11, 2017 and the pilot restarted. The contactor was operated for four weeks collecting influent and effluent samples for 1,4 dioxane analyses at 10-day increments. Final samples were collected on November 8, 2017 and the pilot contactor was shut down.

During the pilot study the GAC contactor was operated at 0.4 gpm providing 11 minutes of empty bed contact time through the media. Flow entered the top of the contactor column and flowed in a downflow direction through the GAC media. Contactor effluent drained to ground.

Data

Table 1 summarizes the lab data collected during the testing.

Table 1: Influent and Effluent 1,4 Dioxane Concentrations from Lab Analyses

Sample Date	Alpha Report No.	GAC Type	Duration (Days)	1,4 Dioxane Concentration (µg/L)		Notes
				GAC Contactor Influent Raw Blend Well 1 + Well 2	GAC Contactor Effluent	
10/6/2017	L1736112	Centaur HSL 8x30	0	0.464	<0.147	Initially Installed Incorrect GAC. Sample Round 1.
10/11/2017	L1736665	Filtrasorb 400	0	0.342	<0.153	Removed Incorrect GAC. Installed Proper GAC and Restarted. Sample Round 1 (repeated).
10/20/2017	L1738164	Filtrasorb 400	9	0.308	<0.150	Sample Round 2
10/31/2017	L1739664	Filtrasorb 400	20	0.309	0.378	Sample Round 3
11/8/2017	L1740891	Filtrasorb 400	28	0.325	0.349	Sample Round 4. Shutdown After 4 Weeks of Operation.

Note: The full lab reports are appended to the end of the letter report.

The data shows that the raw concentration of 1,4 dioxane was reduced to below detection limits at startup and after 9 days of operation. The samples collected after 20 and 28 days of operation indicated no removal of 1,4 dioxane through the contactor and possible contaminant shedding, as effluent concentrations exceeded raw concentrations in both samples.

Please feel free to contact either myself or Erik Grotton at any time to discuss any questions regarding the methods or results of these analyses:

Erik Grotton: Cell: 508-294-3714; email: egrotton@blueleafwater.com
Aaron Davis: Cell: 774-200-8029; email: adavis@blueleafwater.com

Thank you,

Aaron Davis, Project Manager, Blueleaf, Inc.

ANALYTICAL REPORT

Lab Number:	L1736112
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Aaron Davis
Phone:	(508) 248-7094
Project Name:	BARNSTABLE
Project Number:	20107
Report Date:	10/19/17

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

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

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1736112
Report Date: 10/19/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1736112-01	FILTER INF	DW	BARNSTABLE, MA	10/06/17 12:00	10/06/17
L1736112-02	FILTER EFF	DW	BARNSTABLE, MA	10/06/17 12:00	10/06/17

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1736112
Report Date: 10/19/17

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. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated 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.

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 table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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 Client Service Representative 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 Client Services at 800-624-9220 with any questions.

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1736112
Report Date: 10/19/17

Case Narrative (continued)

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: Elizabeth Porta

Title: Technical Director/Representative

Date: 10/19/17

ORGANICS

SEMIVOLATILES

Project Name: BARNSTABLE
Project Number: 20107
Lab Number: L1736112
Report Date: 10/19/17

SAMPLE RESULTS

Lab ID: L1736112-01
Client ID: FILTER INF
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 10/19/17 06:37
Analyst: TJ

Date Collected: 10/06/17 12:00
Date Received: 10/06/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 10/18/17 14:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.464		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	90		70-130

Project Name: BARNSTABLE
Project Number: 20107
Lab Number: L1736112
Report Date: 10/19/17

SAMPLE RESULTS

Lab ID: L1736112-02
Client ID: FILTER EFF
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 10/19/17 07:00
Analyst: TJ

Date Collected: 10/06/17 12:00
Date Received: 10/06/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 10/18/17 14:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	91		70-130

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1736112
Report Date: 10/19/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 120,522
Analytical Date: 10/18/17 15:55
Analyst: TJ

Extraction Method: EPA 522
Extraction Date: 10/18/17 14:00

Parameter	Result	Qualifier	Units	RL	MDL
1,4 Dioxane by EPA 522 - Mansfield Lab for sample(s): 01-02 Batch: WG1053769-1					
1,4-Dioxane	ND		ug/l	0.150	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	72		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: BARNSTABLE

Project Number: 20107

Lab Number: L1736112

Report Date: 10/19/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-02 Batch: WG1053769-2 WG1053769-3								
1,4-Dioxane	96		85		70-130	12		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,4-Dioxane-d8	80		73		70-130

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1736112
Report Date: 10/19/17

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(*)
L1736112-01A	Amber 500ml NaSulfite/NaHSO4 preserved	A	4	4	3.2	Y	Absent		A2-14DIOXANE-522(28)
L1736112-01B	Amber 500ml NaSulfite/NaHSO4 preserved	A	4	4	3.2	Y	Absent		A2-14DIOXANE-522(28)
L1736112-02A	Amber 500ml NaSulfite/NaHSO4 preserved	A	4	4	3.2	Y	Absent		A2-14DIOXANE-522(28)
L1736112-02B	Amber 500ml NaSulfite/NaHSO4 preserved	A	4	4	3.2	Y	Absent		A2-14DIOXANE-522(28)

*Values in parentheses indicate holding time in days

Project Name:	BARNSTABLE	**Lab Number:**	L1736112
Project Number:	20107	**Report Date:**	10/19/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	BARNSTABLE	**Lab Number:**	L1736112
Project Number:	20107	**Report Date:**	10/19/17

Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name: BARNSTABLE
Project Number: 20107
Lab Number: L1736112
Report Date: 10/19/17

REFERENCES

120 Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography/Mass Spectrometry (GC/MS) with Selected Ion Monitoring (SIM). EPA Method 522, EPA/600/R-08/101. Version 1.0, September 2008.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

MANSFIELD CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL
WESTBORO, MA TEL: 508-898-9220 FAX: 508-898-9193
MANSFIELD, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab: 10/6/17

ALPHA Job #: L1736112

Client Information

Client: BLUELEAF INC
Address: 57 DRESSER HILL RD
CHARLTON, MA 01507
Phone: (774) 200-8029
Fax:
Email: adavis@blueleafwater.com
☐ These samples have been previously analyzed by Alpha

Project Information

Project Name: BARNSTABLE
Project Location: BARNSTABLE, MA
Project #: 20107
Project Manager: AARON DAVIS
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)
Date Due: Time:

Report Information - Data Deliverables

☐ FAX ☒ EMAIL
☐ ADEx ☐ Add'l Deliverables

Billing Information

☒ Same as Client info PO #:

Regulatory Requirements/Report Limits

State /Fed Program | Criteria

Other Project Specific Requirements/Comments/Detection Limits:

PLEASE NOTE
MS/MSD (at unit cost) will be omitted unless you check here: ☐

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	ANALYSIS: 1,4 dioxane	SAMPLE HANDLING	TOTAL # BOTTLES
36112.01	FILTER INF	10/6/17	12:00	DW	BJS	1		2
.02	FILTER EFF	10/6/17	12:00	DW	BJS	1		2

SAMPLE HANDLING
Filtration
☐ Done
☐ Not needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)
Sample Specific Comments

Container Type
Preservative

Relinquished By:	Date/Time	Received By:	Date/Time
MCM	10/6/17 13:36	Danielle Mott	10/6/17 13:36
	10/6/17 1530	MSM	10/6/17 1533
	10/6/17 1633	Kim Baker	10/6/17 16:35

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 101-09 (rev. 27-SEP-10)

ANALYTICAL REPORT

Lab Number:	L1736665
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Aaron Davis
Phone:	(508) 248-7094
Project Name:	BARNSTABLE, MA
Project Number:	20107
Report Date:	10/23/17

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

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

Project Name: BARNSTABLE, MA
Project Number: 20107

Lab Number: L1736665
Report Date: 10/23/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1736665-01	FILTER INF	DW	BARNSTABLE, MA	10/11/17 12:00	10/11/17
L1736665-02	FILTER EFF	DW	BARNSTABLE, MA	10/11/17 12:00	10/11/17

Project Name: BARNSTABLE, MA
Project Number: 20107

Lab Number: L1736665
Report Date: 10/23/17

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. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated 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.

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 table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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 Client Service Representative 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 Client Services at 800-624-9220 with any questions.

Project Name: BARNSTABLE, MA
Project Number: 20107

Lab Number: L1736665
Report Date: 10/23/17

Case Narrative (continued)

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: Elizabeth Porta

Title: Technical Director/Representative

Date: 10/23/17

ORGANICS

SEMIVOLATILES

Project Name: BARNSTABLE, MA
Project Number: 20107
Lab Number: L1736665
Report Date: 10/23/17

SAMPLE RESULTS

Lab ID: L1736665-01
Client ID: FILTER INF
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 10/19/17 07:23
Analyst: TJ

Date Collected: 10/11/17 12:00
Date Received: 10/11/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 10/18/17 14:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.342		ug/l	0.150	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	79		70-130

Project Name: BARNSTABLE, MA
Project Number: 20107
Lab Number: L1736665
Report Date: 10/23/17

SAMPLE RESULTS

Lab ID: L1736665-02
Client ID: FILTER EFF
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 10/19/17 07:46
Analyst: TJ

Date Collected: 10/11/17 12:00
Date Received: 10/11/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 10/18/17 14:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.153	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	85		70-130

Project Name: BARNSTABLE, MA
Project Number: 20107
Lab Number: L1736665
Report Date: 10/23/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 120,522
Analytical Date: 10/18/17 15:55
Analyst: TJ

Extraction Method: EPA 522
Extraction Date: 10/18/17 14:00

Parameter	Result	Qualifier	Units	RL	MDL
1,4 Dioxane by EPA 522 - Mansfield Lab for sample(s): 01-02 Batch: WG1053769-1					
1,4-Dioxane	ND		ug/l	0.150	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	72		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: BARNSTABLE, MA

Project Number: 20107

Lab Number: L1736665

Report Date: 10/23/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-02 Batch: WG1053769-2 WG1053769-3								
1,4-Dioxane	96		85		70-130	12		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,4-Dioxane-d8	80		73		70-130

Project Name: BARNSTABLE, MA
Project Number: 20107

Lab Number: L1736665
Report Date: 10/23/17

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(*)
L1736665-01A	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	2.0	Y	Absent		A2-14DIOXANE-522(28)
L1736665-01B	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	2.0	Y	Absent		A2-14DIOXANE-522(28)
L1736665-02A	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	2.0	Y	Absent		A2-14DIOXANE-522(28)
L1736665-02B	Amber 500ml NaSulfite/NaHSO4 preserved	A	<4	<4	2.0	Y	Absent		A2-14DIOXANE-522(28)

*Values in parentheses indicate holding time in days

Project Name:	BARNSTABLE, MA	**Lab Number:**	L1736665
Project Number:	20107	**Report Date:**	10/23/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	BARNSTABLE, MA	**Lab Number:**	L1736665
Project Number:	20107	**Report Date:**	10/23/17

Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

REFERENCES

120 Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography/Mass Spectrometry (GC/MS) with Selected Ion Monitoring (SIM). EPA Method 522, EPA/600/R-08/101. Version 1.0, September 2008.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

CHAIN OF COUNTY

PAGE 1 OF 1

ALPHA ANALYTICAL World Class Chemistry
8 Walkup Drive, Westboro, MA 01581, Tel: 508-898-9220
320 Forbes Blvd, Mansfield, MA 02048, Tel: 508-822-9300

Date Rec'd in Lab: 10/11/17

ALPHA Job #: L1736665

Client Information

Client: BLUELEAF INC
Address: 57 PRESSER HILL RD, CHARLTON, MA 01507
Phone: 774-200-8029
Email: aadavis@blueleafwater.com

Additional Project Information:

Project Information

Project Name: BARNSTABLE, MA
Project Location: BARNSTABLE, MA
Project #: 20107
Project Manager: AARON DAVIS
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)

Date Due:

Report Information - Data Deliverables

☐ ADEx ☒ EMAIL

Billing Information

☒ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program ____ Criteria ____

ANALYSIS: VOC: ☐ 8260 ☐ 624 ☐ 524.2; SVOC: ☐ ABN ☐ PAH; METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15; METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13; EPH: ☐ Ranges & Targets ☐ Ranges Only; VPH: ☐ Ranges & Targets ☐ Ranges Only; ☐ PCB ☐ PEST; TPH: ☐ Quant Only ☐ Fingerprint; 1,4 dioxane

SAMPLE INFO — Filtration: ☐ Field ☐ Lab to do; Preservation: ☐ Lab to do

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	1,4 dioxane	Sample Comments	TOTAL # BOTTLES
36665-01	FILTER INF	10/11	12:00	DW	BJS	X		2
02	FILTER EFF	10/11	12:00	DW	BJS	X		2
Container Type						A		
Preservative						G		

Container Type: P= Plastic, A= Amber glass, V= Vial, G= Glass, B= Bacteria cup, C= Cube, O= Other, E= Encore, D= BOD Bottle

Preservative: A= None, B= HCl, C= HNO_3, D= H_2SO_4, E= NaOH, F= MeOH, G= $NaHSO_4$, H = $Na_2S_2O_3$, I= Ascorbic Acid, J = NH_4Cl, K= Zn Acetate, O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	10/11 15:07	[signature]	10/11/17 15:07
[signature] AAL	10/11/17 15:15	MGM	10/11/17 1515
MGM	10/11/17 1650	[signature]	10/11/17 1650

Project Name: BARNSTABLE, MA
Project Number: 20107

Lab Number: L1738164
Report Date: 10/26/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1738164-01	FILTER INF 10/20	DW	BARNSTABLE, MA	10/20/17 08:00	10/20/17
L1738164-02	FILTER EFF 10/20	DW	BARNSTABLE, MA	10/20/17 08:00	10/20/17

Project Name: BARNSTABLE, MA
Project Number: 20107

Lab Number: L1738164
Report Date: 10/26/17

Case Narrative

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Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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Please contact Client Services at 800-624-9220 with any questions.

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: Susan E O'Neil Susan O' Neil

Title: Technical Director/Representative Date: 10/26/17

ORGANICS

SEMIVOLATILES

Project Name: BARNSTABLE, MA
Project Number: 20107
Lab Number: L1738164
Report Date: 10/26/17

SAMPLE RESULTS

Lab ID: L1738164-01
Client ID: FILTER INF 10/20
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 10/24/17 10:44
Analyst: TJ

Date Collected: 10/20/17 08:00
Date Received: 10/20/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 10/23/17 13:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.308		ug/l	0.156	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	74		70-130

Project Name: BARNSTABLE, MA
Project Number: 20107
Lab Number: L1738164
Report Date: 10/26/17

SAMPLE RESULTS

Lab ID: L1738164-02
Client ID: FILTER EFF 10/20
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 10/24/17 11:14
Analyst: TJ

Date Collected: 10/20/17 08:00
Date Received: 10/20/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 10/23/17 13:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	ND		ug/l	0.150	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	75		70-130

Project Name: BARNSTABLE, MA
Project Number: 20107

Lab Number: L1738164
Report Date: 10/26/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 120,522
Analytical Date: 10/23/17 14:25
Analyst: TJ

Extraction Method: EPA 522
Extraction Date: 10/23/17 13:00

Parameter	Result	Qualifier	Units	RL	MDL
1,4 Dioxane by EPA 522 - Mansfield Lab for sample(s): 01-02 Batch: WG1055340-1					
1,4-Dioxane	ND		ug/l	0.150	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	70		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: BARNSTABLE, MA

Project Number: 20107

Lab Number: L1738164

Report Date: 10/26/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-02 Batch: WG1055340-2 WG1055340-3								
1,4-Dioxane	103		94		70-130	9		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,4-Dioxane-d8	70		79		70-130

Project Name: BARNSTABLE, MA
Project Number: 20107

Lab Number: L1738164
Report Date: 10/26/17

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(*)
L1738164-01A	Amber 500ml NaSulfite/NaHSO4 preserved	A	4	4	2.9	Y	Absent		A2-14DIOXANE-522(28)
L1738164-01B	Amber 500ml NaSulfite/NaHSO4 preserved	A	4	4	2.9	Y	Absent		A2-14DIOXANE-522(28)
L1738164-02A	Amber 500ml NaSulfite/NaHSO4 preserved	A	4	4	2.9	Y	Absent		A2-14DIOXANE-522(28)
L1738164-02B	Amber 500ml NaSulfite/NaHSO4 preserved	A	4	4	2.9	Y	Absent		A2-14DIOXANE-522(28)

*Values in parentheses indicate holding time in days

Project Name:	BARNSTABLE, MA	**Lab Number:**	L1738164
Project Number:	20107	**Report Date:**	10/26/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	BARNSTABLE, MA	**Lab Number:**	L1738164
Project Number:	20107	**Report Date:**	10/26/17

Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name: BARNSTABLE, MA
Project Number: 20107
Lab Number: L1738164
Report Date: 10/26/17

REFERENCES

120 Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography/Mass Spectrometry (GC/MS) with Selected Ion Monitoring (SIM). EPA Method 522, EPA/600/R-08/101. Version 1.0, September 2008.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

ALPHA ANALYTICAL

8 Walkup Drive, Westboro, MA 01581, Tel: 508-898-9220

320 Forbes Blvd, Mansfield, MA 02048, Tel: 508-822-9300

CHAIN OF COUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 10/20/17

ALPHA Job #: L1738164

Project Information

Project Name: BARNSTABLE, MA

Project Location: BARNSTABLE, MA

Project #: 20107

Project Manager: AARON DAVIS

ALPHA Quote #:

Report Information - Data Deliverables

☐ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info PO #:

Client Information

Client: BLUELEAF INC

Address: 57 DRESER HILL RD, CHARLTON, MA 01507

Phone: 774-200-8029

Email: adavis@blueleafweb.com

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods

☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)

☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)

☐ Yes ☐ No NPDES RGP

☐ Other State /Fed Program ______ Criteria ______

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)

Date Due:

Additional Project Information:

ANALYSIS: VOC: ☐ 8260 ☐ 624 ☐ 524.2; SVOC: ☐ ABN ☐ PAH; METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15; METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13; EPH: ☐ Ranges & Targets ☐ Ranges Only; VPH: ☐ Ranges & Targets ☐ Ranges Only; ☐ PCB ☐ PEST; TPH: ☐ Quant Only ☐ Fingerprint; 1,4 DIOXANE

SAMPLE INFO — Filtration: ☐ Field ☐ Lab to do; Preservation: ☐ Lab to do

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	1,4 DIOXANE	Sample Comments	TOTAL # BOTTLES
38164.01	FILTER INF 10/20	10/20/17	8:00	DW	BJS	X		2
.02	FILTER EFF 10/20	10/20/17	8:00	DW	BJS	X		2

Container Type

Preservative

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	10/20 13:38	[signature] AAL	10/20/17 1338
[signature]	10/20/17 1927	[signature]	10/20/17 1927

FORM NO: 01-01 (rev. 12-Mar-2012)

ANALYTICAL REPORT

Lab Number:	L1739664
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Aaron Davis
Phone:	(508) 248-7094
Project Name:	BARNSTABLE
Project Number:	20107
Report Date:	11/07/17

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

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

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1739664
Report Date: 11/07/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1739664-01	FILTER INF	DW	BARNSTABLE, MA	10/31/17 13:00	10/31/17
L1739664-02	FILTER EFF	DW	BARNSTABLE, MA	10/31/17 13:00	10/31/17

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1739664
Report Date: 11/07/17

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. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated 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.

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 table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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 Client Service Representative 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 Client Services at 800-624-9220 with any questions.

Project Name:	BARNSTABLE	**Lab Number:**	L1739664
Project Number:	20107	**Report Date:**	11/07/17

Case Narrative (continued)

1,4-Dioxane by Method 522

The Effluent (L1739664-02) result is greater than the Influent (L1739664-01) result. The sample containers were verified as being labeled correctly by the laboratory.

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: Elizabeth Porta

Title: Technical Director/Representative Date: 11/07/17

ORGANICS

SEMIVOLATILES

Project Name: BARNSTABLE
Project Number: 20107
Lab Number: L1739664
Report Date: 11/07/17

SAMPLE RESULTS

Lab ID: L1739664-01
Client ID: FILTER INF
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 11/02/17 18:32
Analyst: TJ

Date Collected: 10/31/17 13:00
Date Received: 10/31/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 11/02/17 05:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.309		ug/l	0.150	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	76		70-130

Project Name: BARNSTABLE
Project Number: 20107
Lab Number: L1739664
Report Date: 11/07/17

SAMPLE RESULTS

Lab ID: L1739664-02
Client ID: FILTER EFF
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 11/02/17 18:57
Analyst: TJ

Date Collected: 10/31/17 13:00
Date Received: 10/31/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 11/02/17 05:00

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.378		ug/l	0.147	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	79		70-130

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1739664
Report Date: 11/07/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 120,522
Analytical Date: 11/02/17 07:03
Analyst: TJ

Extraction Method: EPA 522
Extraction Date: 11/02/17 05:00

Parameter	Result	Qualifier	Units	RL	MDL
1,4 Dioxane by EPA 522 - Mansfield Lab for sample(s): 01-02 Batch: WG1058883-1					
1,4-Dioxane	ND		ug/l	0.150	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	85		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: BARNSTABLE

Project Number: 20107

Lab Number: L1739664

Report Date: 11/07/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-02 Batch: WG1058883-2 WG1058883-3								
1,4-Dioxane	87		93		70-130	7		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,4-Dioxane-d8	87		83		70-130

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1739664
Report Date: 11/07/17

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(*)
L1739664-01A	Amber 500ml NaSulfite/NaHSO4 preserved	A	4	4	5.6	Y	Absent		A2-14DIOXANE-522(28)
L1739664-01B	Amber 500ml NaSulfite/NaHSO4 preserved	A	4	4	5.6	Y	Absent		A2-14DIOXANE-522(28)
L1739664-02A	Amber 500ml NaSulfite/NaHSO4 preserved	A	4	4	5.6	Y	Absent		A2-14DIOXANE-522(28)
L1739664-02B	Amber 500ml NaSulfite/NaHSO4 preserved	A	4	4	5.6	Y	Absent		A2-14DIOXANE-522(28)

*Values in parentheses indicate holding time in days

Project Name:	BARNSTABLE	**Lab Number:**	L1739664
Project Number:	20107	**Report Date:**	11/07/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	BARNSTABLE	**Lab Number:**	L1739664
Project Number:	20107	**Report Date:**	11/07/17

Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name: BARNSTABLE
Project Number: 20107
Lab Number: L1739664
Report Date: 11/07/17

REFERENCES

120 Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography/Mass Spectrometry (GC/MS) with Selected Ion Monitoring (SIM). EPA Method 522, EPA/600/R-08/101. Version 1.0, September 2008.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

CHAIN OF CUSTODY

PAGE ____ OF ____

Date Rec'd in Lab: 10/31/17

ALPHA Job #: L1739664

ALPHA ANALYTICAL
8 Walkup Drive, Westboro, MA 01581, Tel: 508-898-9220
320 Forbes Blvd, Mansfield, MA 02048, Tel: 508-822-9300

Client Information

Client: BLUELEAF INC

Address: 57 DRESSER HILL RD
CHARLTON, MA 01507

Phone: 774-200-8029

Email: adavis@blueleafwater.com

Additional Project Information:

Project Information

Project Name: BARNSTABLE

Project Location: BARNSTABLE, MA

Project #: 20107

Project Manager: AARON DAVIS

ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)

Date Due:

Report Information - Data Deliverables

☐ ADEx ☒ EMAIL

Billing Information

☒ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	ANALYSIS: 1,4 DIOXANE	SAMPLE INFO: Filtration ☐ Field ☐ Lab to do; Preservation ☐ Lab to do	Sample Comments	TOTAL # BOTTLES
39664.01	FILTER INF	10/31	13:00	DW	BJS	X			2
02	FILTER EFF	10/31	13:00	DW	BJS	X			2

Container Type
Preservative

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
	10/31 15:01		10/31/17 15
	10/31/17 2045		10/31/17 20:4

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

ANALYTICAL REPORT

Lab Number:	L1740891
Client:	Blueleaf Incorporated 57 Dresser Hill Road Charlton, MA 01507
ATTN:	Aaron Davis
Phone:	(508) 248-7094
Project Name:	BARNSTABLE
Project Number:	20107
Report Date:	11/21/17

Certifications & Approvals: MA (M-MA030), NH NELAP (2062), NJ NELAP (MA015), CT (PH-0141), FL (E87814), IL (200081), LA (85084), ME (MA00030), MD (350), 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 #P330-13-00067), USFWS (Permit #LE2069641).

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

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1740891
Report Date: 11/21/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1740891-01	FILTER INF	DW	BARNSTABLE, MA	11/08/17 10:00	11/08/17
L1740891-02	FILTER EFF	DW	BARNSTABLE, MA	11/08/17 10:00	11/08/17

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1740891
Report Date: 11/21/17

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. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated 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.

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 table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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 Client Service Representative 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 Client Services at 800-624-9220 with any questions.

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:  Susan O' Neil

Title: Technical Director/Representative Date: 11/21/17

ORGANICS

SEMIVOLATILES

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1740891
Report Date: 11/21/17

SAMPLE RESULTS

Lab ID: L1740891-01
Client ID: FILTER INF
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 11/20/17 18:18
Analyst: TJ

Date Collected: 11/08/17 10:00
Date Received: 11/08/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 11/20/17 09:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.325		ug/l	0.150	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	81		70-130

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1740891
Report Date: 11/21/17

SAMPLE RESULTS

Lab ID: L1740891-02
Client ID: FILTER EFF
Sample Location: BARNSTABLE, MA

Matrix: Dw
Analytical Method: 120,522
Analytical Date: 11/20/17 19:01
Analyst: TJ

Date Collected: 11/08/17 10:00
Date Received: 11/08/17
Field Prep: Not Specified
Extraction Method: EPA 522
Extraction Date: 11/20/17 09:30

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
1,4 Dioxane by EPA 522 - Mansfield Lab						
1,4-Dioxane	0.349		ug/l	0.153	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	79		70-130

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1740891
Report Date: 11/21/17

Method Blank Analysis
Batch Quality Control

Analytical Method: 120,522
Analytical Date: 11/20/17 11:03
Analyst: TJ

Extraction Method: EPA 522
Extraction Date: 11/20/17 09:30

Parameter	Result	Qualifier	Units	RL	MDL
1,4 Dioxane by EPA 522 - Mansfield Lab for sample(s): 01-02 Batch: WG1064875-1					
1,4-Dioxane	ND		ug/l	0.150	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	82		70-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: BARNSTABLE

Project Number: 20107

Lab Number: L1740891

Report Date: 11/21/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-02 Batch: WG1064875-2 WG1064875-3								
1,4-Dioxane	78		72		70-130	8		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,4-Dioxane-d8	77		73		70-130

Matrix Spike Analysis

Batch Quality Control

Project Name: BARNSTABLE

Project Number: 20107

Lab Number: L1740891

Report Date: 11/21/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-02 QC Batch ID: WG1064875-5 QC Sample: L1740891-02 Client ID: FILTER EFF												
1,4-Dioxane	0.349	0.962	1.11	79		-	-		70-130	-		30

Surrogate	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
1,4-Dioxane-d8	84				70-130

Lab Duplicate Analysis
Batch Quality Control

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1740891
Report Date: 11/21/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
1,4 Dioxane by EPA 522 - Mansfield Lab Associated sample(s): 01-02 QC Batch ID: WG1064875-4 QC Sample: L1740891-01 Client ID: FILTER INF						
1,4-Dioxane	0.325	0.330	ug/l	2		30

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
1,4-Dioxane-d8	81		85		70-130

Project Name: BARNSTABLE
Project Number: 20107

Lab Number: L1740891
Report Date: 11/21/17

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(*)
L1740891-01A	Amber 500ml NaSulfite/NaHSO4 preserved	A	4	4	5.7	Y	Absent		A2-14DIOXANE-522(28)
L1740891-01B	Amber 500ml NaSulfite/NaHSO4 preserved	A	4	4	5.7	Y	Absent		A2-14DIOXANE-522(28)
L1740891-02A	Amber 500ml NaSulfite/NaHSO4 preserved	A	4	4	5.7	Y	Absent		A2-14DIOXANE-522(28)
L1740891-02B	Amber 500ml NaSulfite/NaHSO4 preserved	A	4	4	5.7	Y	Absent		A2-14DIOXANE-522(28)

*Values in parentheses indicate holding time in days

Project Name:	BARNSTABLE	**Lab Number:**	L1740891
Project Number:	20107	**Report Date:**	11/21/17

GLOSSARY

Acronyms

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).
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.
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.
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.
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.
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.

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.

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'.

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.

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 Condensation Product".
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

Report Format: Data Usability Report

Project Name:	BARNSTABLE	**Lab Number:**	L1740891
Project Number:	20107	**Report Date:**	11/21/17

Data Qualifiers

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.

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.

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

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.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name: BARNSTABLE
Project Number: 20107
Lab Number: L1740891
Report Date: 11/21/17

REFERENCES

120 Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography/Mass Spectrometry (GC/MS) with Selected Ion Monitoring (SIM). EPA Method 522, EPA/600/R-08/101. Version 1.0, September 2008.

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: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
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: 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**
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, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, 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 624: Volatile Halocarbons & Aromatics,
EPA 608: 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: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

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, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

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

CHAIN OF CUSTODY

PAGE ____ OF ____

ALPHA ANALYTICAL

8 Walkup Drive, Westboro, MA 01581, Tel: 508-898-9220
320 Forbes Blvd, Mansfield, MA 02048, Tel: 508-822-9300

Date Rec'd in Lab: 11/8/17

ALPHA Job #: L1740891

Client Information

Client: BLUELEAF INC
Address: 57 DRESSER HILL RD
CHARLTON, MA 01507
Phone: 774-200-8029
Email: adavis@blueleafwater.com

Project Information

Project Name: BARNSTABLE
Project Location: BARNSTABLE, MA
Project #: 20167
Project Manager: AARON DAVIS
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)

Date Due:

Report Information - Data Deliverables

☐ ADEx ☒ EMAIL

Billing Information

☒ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods
☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program ____ Criteria ____

Additional Project Information:

ANALYSIS

VOC: ☐ 8260 ☐ 624 ☐ 524.2; SVOC: ☐ ABN ☐ PAH; METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15; METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13; EPH: ☐ Ranges & Targets ☐ Ranges Only; VPH: ☐ Ranges & Targets ☐ Ranges Only; ☐ PCB ☐ PEST; TPH: ☐ Quant Only ☐ Fingerprint; 1,4 DIOXANE

SAMPLE INFO — Filtration: ☐ Field ☐ Lab to do; Preservation: ☐ Lab to do

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	1,4 DIOXANE	Sample Comments	TOTAL # BOTTLES
40891.01	FILTER INF	11/8	10:00	DW	BJS	X		2
.02	FILTER EFF	11/8	11:00	DW	BJS	X		2

Container Type
Preservative

Container Type: P= Plastic, A= Amber glass, V= Vial, G= Glass, B= Bacteria cup, C= Cube, O= Other, E= Encore, D= BOD Bottle

Preservative: A= None, B= HCl, C= HNO_3, D= H_2SO_4, E= NaOH, F= MeOH, G= $NaHSO_4$, H = $Na_2S_2O_3$, I= Ascorbic Acid, J = NH_4Cl, K= Zn Acetate, O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	11/8/17 1305	[signature] AAL	11/8/17 1305
	11/8/17 2000	[signature]	11/8/17 2000

FORM NO: 01-01 (rev. 12-Mar-2012)

Appendix F

TATA & HOWARD

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

Southeast Regional Office • 20 Riverside Drive, Lakeville MA 02347 • 508-946-2700

LEAD AND COPPER (LCR) REVIEW SUMMARY SHEET
Requirements for Systems that *meet* the Action Levels
(90th percentile result was equal to or less than the Action Level)

The following is a review summary sheet for the results you submitted to the Department of Environmental Protection (MassDEP) for the compliance and monitoring period specified. This sheet is intended to help you remain in compliance with the LCR. To maintain compliance with the LCR you must take the specific action(s) checked (☒) below with their respective compliance dates. Please refer to the Drinking Water Regulations (310 CMR 22.00) for specific requirements relative to Lead and Copper and Consumer Confidence Report Rules.

PWS Name:	HYANNIS WATER SYSTEM	PWS ID#:	4020004	TOWN:	BARNSTABLE

Sampling Date(s): 7/16,18-22,25-26,30,8/2,19,24,31,9/1/2016 **Round #:** 5 ☒ Revised Form
Compliance Period: 1/1/2014 to 12/31/2016 **Frequency:** ☐ Semiannual ☐ Annual ☒ Every 3 Years
Monitoring Period: 6/1/2016 to 9/30/2016 **Number of Samples Required?** 30
School/Childcare samples required per 310 CMR 22.06B(7)(a)9? Yes ☒, No ☐
Is PWS Currently providing treatment? Yes ☒, No ☐

SAMPLING RESULTS FOR LCR COMPLIANCE for the period specified above:

Parameter	Action Level (AL) (mg/l)	90th % (mg/l)	90th % >AL?	# samples	# samples above AL
Lead	0.015	0.000	no	35	0
Copper	1.3	0.230	no	35	0

☒ SCHOOL/CHILDCARE RESULTS for the period specified above:

School/ Sampling Results required by 310 CMR 22.06B(7)(a)9: This is an additional requirement for community water supplies with every sampling round unless the school/childcare facility has its own well. These four diagnostic samples are in addition to the minimum number required and the results are not used in determining the 90th percentiles for lead and copper. These samples are used to educate the school/school district or facility on the importance of lead and copper sampling and the MassDEP Lead Contamination Control Program (LCCA) for schools and facilities. The results for two (2) sampling sites (kitchen and drinking water source, such as a water fountain) for each of two schools/ facilities are summarized in the table below:

School/Childcare Sampling Location	Lead (mg/l)	> AL?	Copper (mg/l)	> AL?
83 Pearl St-Central Bath, Hyannis 1	0.000	no	0.010	yes / no
83 Pearl St-Bath for brushing teeth, Hyannis 3	0.000	no	0.011	yes / no
154 Bearse Way- Main Floor Boys bath	0.000	no	0.036	yes / no
154 Bearse Way- Basement 2	0.000	no	0.260	yes / no

Massachusetts Department of Environmental Protection - Drinking Water Program LCR-C

Lead and Copper Analysis Report

I. PWS INFORMATION: Please refer to your DEP Lead and Copper sampling plan for approved sampling locations.

PWS ID #: 4020004 City / Town: Hyannis

PWS Name: Hyannis Water System PWS Class: COM ☑ NTNC ☐ TNC ☐

Routine or Special Samples	Original, Resubmitted or Confirmation Report	If Resubmitted Report, list below:	
		(1) Reason for Resubmission	(2) Collection Date of Original Sample
☑ RS ☐ SS	☑ Original ☐ Resubmitted ☐ Confirmation	☐ Resample ☐ Reanalysis ☐ Report Correction	

SAMPLE NOTES- (Such as , If a Manifold/Multiple sample, list the sources that were on-line during sample collection).

II. ANALYTICAL LABORATORY INFORMATION:

Primary Lab MA Cert #: M-MA009 Primary Lab Name: Barnstable County Health Lab Subcontracted? (Y/N) N

Analyte	Action Level (mg/L)	Lab Method	MDL (mg/L)	Analysis Lab MA Cert.#	Analysis Lab Name
Lead:	0.015	EPA 200.8	0.0010	M-MA009	Barnstable County Health Lab
Copper:	1.3	EPA 200.8	0.0010	M-MA009	Barnstable County Health Lab

LAB SAMPLE NOTES

	DEP Approved Sample Location (See DEP approved LCR plan for sampling locations)		Collection Date	LEAD		COPPER		Lab Sample ID#
				Result (mg/L)	Date Analyzed	Result (mg/L)	Date Analyzed	
1	46 Lexington	✓	07/30/2016	ND	08/10/2016	0.063	08/10/2016	1695505-01
2	257 Arrowhead	✓	08/02/2016	ND	08/10/2016	0.12	08/10/2016	1695505-02

I certify under penalties of law that I am the person authorized to fill out this form and the information contain herein is true, accurate and complete to the best extent of my knowledge.

Primary Lab Director Signature: Benjamin Lee

Date: 8/17/2016

If not submitting these results electronically, mail ONE copy of this report to your DEP Regional Office no later than 10 days after the end of the month in which you received this report or no later than 10 days after the end of the reporting period, whichever is sooner.

COM and NTNC Public Water Suppliers must submit Forms LCR-D or LCR-E with this form to the appropriate DEP Regional Office.

DEP REVIEW STATUS (Initial Date)	Review Comments
☐ Accepted _____ ☐ Disapproved _____	

Massachusetts Department of Environmental Protection - Drinking Water Program LCR-C

Lead and Copper Analysis Report

I. PWS INFORMATION: Please refer to your DEP Lead and Copper sampling plan for approved sampling locations.

PWS ID #: 4020004 City / Town: Hyannis

PWS Name: Hyannis Water System PWS Class: COM ☑ NTNC ☐ TNC ☐

Routine or Special Samples	Original, Resubmitted or Confirmation Report	If Resubmitted Report, list below:	
		(1) Reason for Resubmission	(2) Collection Date of Original Sample
☑ RS ☐ SS	☑ Original ☐ Resubmitted ☐ Confirmation	☐ Resample ☐ Reanalysis ☐ Report Correction	

SAMPLE NOTES: (Such as , if a Manifold/Multiple sample, list the sources that were on-line during sample collection)

II. ANALYTICAL LABORATORY INFORMATION:

Primary Lab MA Cert #: M-MA009 Primary Lab Name: Barnstable County Health Lab Subcontracted? (Y/N) N

Analyte	Action Level (mg/L)	Lab Method	MDL (mg/L)	Analysis Lab MA Cert.#	Analysis Lab Name
Lead:	0.015	EPA 200.8	0.0010	M-MA009	Barnstable County Health Lab
Copper:	1.3	EPA 200.8	0.0010	M-MA009	Barnstable County Health Lab

LAB SAMPLE NOTES:

	DEP Approved Sample Location (See DEP approved LCR plan for sampling locations)	Collection Date	LEAD		COPPER		Lab Sample ID#
			Result (mg/L)	Date Analyzed	Result (mg/L)	Date Analyzed	
1	35 Simmons Pond ✓	07/25/2016	ND	08/09/2016	0.047	08/09/2016	1695365-01
2	54 Lexington Dr. ✓	07/26/2016	ND	08/09/2016	0.013	08/09/2016	1695365-02
3	99 Wayland Circle ✓	07/21/2016	ND	08/09/2016	0.10	08/09/2016	1695365-03
4	15 Carla Rd. ✓	07/21/2016	ND	08/09/2016	0.10	08/09/2016	1695365-04
5	52 Wayland Circle ✓	07/20/2016	ND	08/09/2016	0.19	08/09/2016	1695365-05
6	34 Rabbit Ln. ✓	07/22/2016	ND	08/09/2016	0.047	08/09/2016	1695365-06
7	38 Wagon Ln. ✓	07/22/2016	ND	08/09/2016	0.072	08/09/2016	1695365-07
8	58 Lexington Dr. ✓	07/19/2016	ND	08/09/2016	0.076	08/09/2016	1695365-08
9	104 Sudbury Ln. ✓	07/22/2016	ND	08/09/2016	0.049	08/09/2016	1695365-09

I certify under penalties of law that I am the person authorized to fill out this form and the information contein herein is true, accurate and complete to the best extent of my knowledge.

Primary Lab Director Signature: [signature]

Date: 8/10/2016

If not submitting these results electronically, mail ONE copy of this report to your DEP Regional Office no later than 10 days after the end of the month in which you received this report or no later than 10 days after the end of the reporting period, whichever is sooner.

COM and NTNC Public Water Suppliers must submit Forms LCR-D or LCR-E with this form to the appropriate DEP Regional Office.

DEP REVIEW STATUS (Initial Date)	Review Comments
☐ Accepted _____ ☐ Disapproved _____	

Massachusetts Department of Environmental Protection - Drinking Water Program LCR-C

Lead and Copper Analysis Report

I. PWS INFORMATION: Please refer to your DEP Lead and Copper sampling plan for approved sampling locations.

PWS ID #: 4020004 City / Town: Hyannis

PWS Name: Hyannis Water Department PWS Class: COM ☑ NTNC ☐ TNC ☐

Routine or Special Samples	Original, Resubmitted or Confirmation Report	If Resubmitted Report, list below:	
		(1) Reason for Resubmission	(2) Collection Date of Original Sample
☑ RS ☐ SS	☑ Original ☐ Resubmitted ☐ Confirmation	☐ Resample ☐ Reanalysis ☐ Report Correction	

SAMPLE NOTES: (Such as , If a Manifold/Multiple sample, list the sources that were on-line during sample collection)

II. ANALYTICAL LABORATORY INFORMATION:

Primary Lab MA Cert #: M-MA009 Primary Lab Name: Barnstable County Health Lab Subcontracted? (Y/N) N

Analyte	Action Level (mg/L)	Lab Method	MDL (mg/L)	Analysis Lab MA Cert.#	Analysis Lab Name
Lead:	0.015	EPA 200.8	0.0010	M-MA009	Barnstable County Health Lab
Copper:	1.3	EPA 200.8	0.0010	M-MA009	Barnstable County Health Lab

LAB SAMPLE NOTES:

	DEP Approved Sample Location (See DEP approved LCR plan for sampling locations)		Collection Date	LEAD		COPPER		Lab Sample ID#
				Result (mg/L)	Date Analyzed	Result (mg/L)	Date Analyzed	
1	30 Marks Path, Hyannis MA	✓	07/19/2016	ND	07/26/2016	0.19	07/26/2016	1694948-01
2	273 Arrowhead Dr. Hyannis, MA		07/19/2016	0.0032	07/26/2016	0.56	07/26/2016	1694948-02
3	54 Nobadeer Rd. Hyannis, MA	✓	07/16/2016	ND	07/26/2016	0.052	07/26/2016	1694948-03
4	34 Quisset Rd. Hyannis, MA	✓	07/19/2016	ND	07/26/2016	0.23	07/26/2016	1694948-04
5	60 Lexington Dr. Hyannis, MA	✓	07/19/2016	ND	07/26/2016	0.16	07/26/2016	1694948-05
6	145 Sudbury Ln. Hyannis, MA	✓	07/19/2016	ND	07/26/2016	0.25	07/26/2016	1694948-06
7	125 Sudbury Ln. Hyannis, MA	✓	07/19/2016	ND	07/26/2016	0.10	07/26/2016	1694948-07
8	79 Wagon Ln. Hyannis, MA	✓	07/19/2016	ND	07/26/2016	0.068	07/26/2016	1694948-08
9	84 Wayland, Hyannis, MA		07/19/2016	ND	07/26/2016	0.13	07/26/2016	1694948-09
10	8 Simmons Pond Circle, Hyannis, MA	✓	07/19/2016	ND	07/26/2016	0.061	07/26/2016	1694948-10
11	294 Scudder Ave. Hyannis, MA	✓	07/19/2016	0.0080	07/26/2016	0.14	07/26/2016	1694948-11
12	10 Pasture Ln. Hyannis, MA	✓	07/16/2016	ND	07/26/2016	0.034	07/26/2016	1694948-12
13	17 Rabbit Ln. Hyannis, MA	*	07/19/2016	ND	07/26/2016	0.10	07/26/2016	1694948-13
14	35 Pasture Ln. Hyannis, MA	✓	07/19/2016	ND	07/26/2016	0.11	07/26/2016	1694948-14
15	39 Wellesely Circle, Hyannis, MA	✓	07/19/2016	ND	07/26/2016	0.096	07/26/2016	1694948-15
16	62 Quisset Rd. Hyannis, MA	✓	07/19/2016	ND	07/26/2016	0.040	07/26/2016	1694948-16
17	127 Nobadeer Rd. Hyannis, MA	✓	07/19/2016	ND	07/26/2016	0.072	07/26/2016	1694948-17
18	25 Pasture Ln. Hyannis, MA	✓	07/18/2016	ND	07/26/2016	0.14	07/26/2016	1694948-18
19	39 Peacock Ln. Hyannis, MA	✓	07/16/2016	ND	07/26/2016	0.026	07/26/2016	1694948-19

I certify under penalties of law that I am the person authorized to fill out this form and the information contain herein is true, accurate and complete to the best extent of my knowledge.

Primary Lab Director Signature: Benjamin Lee

Date: 8/5/2016

If not submitting these results electronically, mail ONE copy of this report to your DEP Regional Office no later than 10 days after the end of the month in which you received this report or no later than 10 days after the end of the reporting period, whichever is sooner.

COM and NTNC Public Water Suppliers must submit Forms LCR-D or LCR-E with this form to the appropriate DEP Regional Office.

DEP REVIEW STATUS (Initial Date)	Review Comments
☐ Accepted _____ ☐ Disapproved _____	

Appendix G

TATA & HOWARD

Appendix G
Proposed Project Schedule -Engineering and Construction
Maher Filtration Plant
Option No. 2 – Greensand Filtration, Advanced Oxidation, and GAC Filtration
Barnstable, Massachusetts

Date	Milestone
January 17, 2018	Submit pilot test report to Town and MassDEP
March 16, 2018	Receive MassDEP response/approval of pilot test report and New Technology Approval[1]
April 25, 2018	Submit 50% draft design plans to Town
July 17, 2018	Submit 90% draft design plans and specifications to Town and MassDEP for BRP WS 24 Approval and DWSRF approval[2]
August 17, 2018	Receive MassDEP approval of design documents and DWSRF approval[3]
August 22, 2018	Submit 99% draft plans and specifications to Town for DPW Administration approval
September 19, 2018	Bid advertisement/bid documents available
September 26, 2018	Pre-bid conference
October 10, 2018	Sub-bid opening
October 31, 2018	General bid opening
November 16, 2018	Receive DWSRF Authorization to Award
December 7, 2018	Execute construction contract
December 20, 2018	Preconstruction conference
January 10, 2019	Shop drawing reviews[4]
January 20, 2019	Start construction
May 24, 2020	Begin full facility startup
July 19, 2020	Complete construction and facility fully on-line[5]

[1] A 60-day review period by the MassDEP is assumed.
[2] Assumes one 90% draft review of the plans and specifications by the Town and return of 90% draft edits and comments to Tata & Howard by August 7, 2018.
[3] A 30-day expedited review period by the MassDEP is assumed.
[4] This marks the date of initial shop drawing reviews required for the start of construction. Additional shop drawing reviews will occur during construction.
[5] Assumes an 18-month construction period.

TATA & HOWARD

OFFICE LOCATIONS:
MA | NH | CT | ME | VT | AZ | TX

800-366-5760
www.tataandhoward.com