COMPREHENSIVE
ENVIRONMENTAL
INCORPORATED

41 Main Street
Bolton, MA 01740
www.ceiengineers.com

August 15, 2019

MassDEP, Drinking Water Program
Attn: Paula Caron
8 New Bond Street
Worcester, MA 01606

RE: Proposed Manganese Compliance Plan

Dear Ms. Caron:

On behalf of the Town of Groton Water Department (Town), Comprehensive Environmental Inc. (CEI) is submitting a proposed manganese compliance plan in accordance with a letter issued by MassDEP on February 25, 2019. The letter indicates that manganese test results in Whitney Well #1 and Whitney Well #2 finish water exceeded MassDEP's Office of Research and Standards Guidance Level for manganese and that a draft compliance plan (i.e., corrective action plan) must be submitted by September 1, 2019 to reduce the level of manganese to a level "reliably and consistently" below the 0.30 mg/L Health Advisory Level (HAL) at the entry point to the distribution system and "preferably" below the 0.05 mg/L Secondary Maximum Contaminant Level (SMCL).

Refer to the attached Corrective Action Plan (CAP) for the Town's proposed strategy to address elevated manganese levels at the Whitney Pond Wells. Please contact me should have any questions at 508-281-5177 (mohl@ceiengineers.com).

Sincerely,

COMPREHENSIVE ENVIRONMENTAL INC.

Michael P. Ohl, P.E.[1]
Principal, Project Manager
[1]*Licensed in Massachusetts*

Attachments: Proposed Manganese Corrective Action Plan and Accompanying Figures

Copies to: Thomas Orcutt, Groton Water Department

RESPONSE REQUIRED

Corrective Action Plan (CAP) for addressing manganese levels above the ORSG Level of 0.30 mg/L

CAP Response Due Date: September 1, 2019

PWS ID#: 2115000

PWS Name: Groton Water Department

Instructions: Please complete, sign, date and return this document by the CAP response due date listed about to: **MassDEP, Drinking Water Program, 8 New Bond St., Worcester, MA 01606**

This plan will provide the basis for further documentation of your actions to address manganese levels over the ORSG Level.
In addition to the required notification of public health officials and consumers, a long term corrective action plan must be submitted to MassDEP. When developing a plan, you must consider and include discussion of the following areas and any actions you plan to take to reduce your manganese levels reliably and consistently below 0.30 mg/L:

- ✓ Education and notification to inform sensitive sub-populations;
- ✓ Monitoring additional parameters. It is generally recommended that you routinely monitor and gather enough information to assess levels in affected sources that may account for fluctuations in concentrations above the SMCL, including pumping rates, blending patterns, periodic/seasonal use, and variations in seasonal water quality;
- ✓ Monitoring in the distribution system;
- ✓ Optimization of existing treatment processes (greensand, ion exchange, softeners etc);
- ✓ Managing the use of the source(s) with elevated manganese levels;
- ✓ Use of another source, (please note: new sources must reduce levels below 0.05 mg/L);
- ✓ Blending the source(s) with elevated manganese levels with other source(s);
- ✓ Connection to another PWS with manganese level reliable and consistently below 0.30 mg/L;
- ✓ Treatment options to remove elevated manganese levels including Point-of-Use (POU) or Point-of-Entry (POE) for clearly separate distribution systems. (Please note: sequestration treatment is not an acceptable option because it masks but does not remove manganese); and
- ✓ Other options.

Long-Term Plan

Check one: Preliminary ✓ Final_____

Please identify if the following items have been included in your Long-Term Corrective Action Plan (CAP):			
Possible Corrective Action Plan Topics	**In the CAP**		
Education and notification to inform the sensitive sub population.	Yes	No	N/A
Monitoring additional parameters. It is generally recommended that you routinely monitor and gather enough information to assess levels in affected sources that may account for fluctuations in concentrations above the SMCL, including pumping rates, blending patterns, periodic/seasonal use, and variations in seasonal water quality.	Yes	No	N/A
Monitoring in the distribution system.	Yes	No	N/A
Optimization of existing treatment processes (greensand, ion exchange, softeners etc).	Yes	No	N/A
Managing the use of the source(s) with elevated manganese levels.	Yes	No	N/A
Use of another source, (please note: new sources must reduce levels below 0.5 mg/L)	Yes	No	N/A
Blending the source(s) with elevated manganese levels with other source(s).	Yes	No	N/A
Connection to another public Water Supply with Manganese level reliably and consistently below 0.30 mg/L.	Yes	No	N/A
Treatment options to remove elevated manganese levels. (Sequestration treatment is not an acceptable option because it masks but does not remove manganese).	Yes	No	N/A
Other Options.	Yes	No	N/A

Long-Term Narrative:

In the long-term, my system plans to undertake the following action to address the issue

[Please include a description of the plans you intend to take below, or attach additional pages as necessary]

Alternatives Analysis:

An analysis of potential manganese mitigation alternatives was performed. The most favorable alternative would have the capacity to replace or exceed the approved maximum daily withdrawal of the Whitney Pond Wells (0.576 mgd) while cost effectively providing treated water below the HAL and SMCL. An array of alternatives was considered including use of new sources, treatment, and wholesale water purchase from another PWD. Alternatives were evaluated and scored based on a multi-factor decision matrix that included the following general factors:

- Supply/demand balance: Will the selected alternative meet existing and future supply needs?
- Manganese reduction efficacy: Will the selected alternative provide a long-term reduction in manganese and iron levels?
- Order-of-Magnitude cost: Are capital costs and long-term operation and maintenance costs reasonable?
- Permitting considerations: What extent of permitting will be required for approval of the proposed alternative?

Alternative Selection:

The completed decision matrix was presented to the Groton Water Commissioners at a public meeting on July 23, 2019 where the Commissioners voted unanimously in favor of treating the Whitney Pond Wells at the existing Baddacook Pond Water Filtration Plant (Plant). The selected alternative would involve construction of a raw water transmission main to the Plant and expansion of the Plant's capacity to accommodate treatment of raw water from the Whitney Pond Wells.

This alternative will enable GWD to maintain current supply capacity and retains the option for development of additional sources in the future if demands increase. This alternative would include the following work (**Figure 1**):

- Install approximately 6,800 feet of 8-inch raw water distribution main.

- Install approximately 4,100 feet of 12-inch finished water distribution main.
- Convert approximately 5,500 feet of 12-inch and 1,600 feet of 8-inch water distribution main into finished and raw water distribution main, respectively.
- Expand Baddacook Pond Water Filtration Plant to accommodate Whitney Pond Wells.

It is expected that expansion of the Plant to accommodate the Whitney Pond Wells will result in a long-term reduction of Manganese levels below the HAL and SMCL.

Conceptual Facility Expansion Layout:
The Plant currently utilizes Greensand Plus media filtration to treat the Baddacook Pond Well. The plant would be expanded to include two (2) horizontal filters with Greensand Plus media identical to the existing filters, a bulk storage area for potassium hydroxide, a bulk storage area for sodium hypochlorite, a combined chemical feed area with day tanks for both chemicals, and a finish water metering pit. The proposed layout would also include a new control panel configured to control all four filters.

It is expected that raw water from the Whitney Pond Wells and Baddacook Pond Well will be chemically treated using separate metering pumps and day tanks in the chemical feed area, but will be routed to a common header across all four filters which will allow for operational flexibility. A common backwash header will also be utilized. The firm capacity of the expanded treatment facility would be approximately 1,300 gpm which is equivalent to the approximate maximum pumping capacity of Baddacook Pond Well (250 gpm), Shattuck Well #1 (286 gpm), and the Whitney Pond Wells (750 gpm). Shattuck Well #1 will not be treated at this time, but the Plant expansion will retain the ability to route the Shattuck Well #1 water to the Plant for treatment, at a future time. The design media loading rate to meet firm capacity would be 4.3 gpm/sf (1,300 gpm divided by 3 filters with 100 square feet of media surface each). This filter loading rating is conservative and could potentially be operated at 7 gpm/sf or higher pending successful pilot testing. The manufacturer of GreenSand Plus indicates that the media can handle loading rates of up to 12 gpm/sf.

See **Figure 2** and **Figure 3** for a conceptual site plan and facility layout, including preliminary facility sizing calculations.

Additional CAP Actions:

- The Town will continue to provide manganese health advisory information in annual Consumer Confidence Reports, including notification of new customers and billing units.
- The Town will continue ongoing water quality monitoring and data submittals.

Planned action and date of completion: *[Please include a timeline for the actions outlined above]*	
Action	**To be completed by date:**
See **Figure 4** for a proposed milestone-based schedule.	

I certify under the penalty of law that I am the person authorized to fil out this form and the information contained herein is true, accurate and complete to the best of my knowledge and belief.

Name: Tom Orcutt — Title: Superintendent

Signature: — Date: August 15, 2019

Phone: (978) 448-1122 — Email: torcutt@townofgroton.org

Corrective Action Plan (CAP) for addressing manganese levels above the ORSG Level of 0.30 mg/L
Technical Assistance Requested: *(Please fill in your contact information if requesting assistance)*

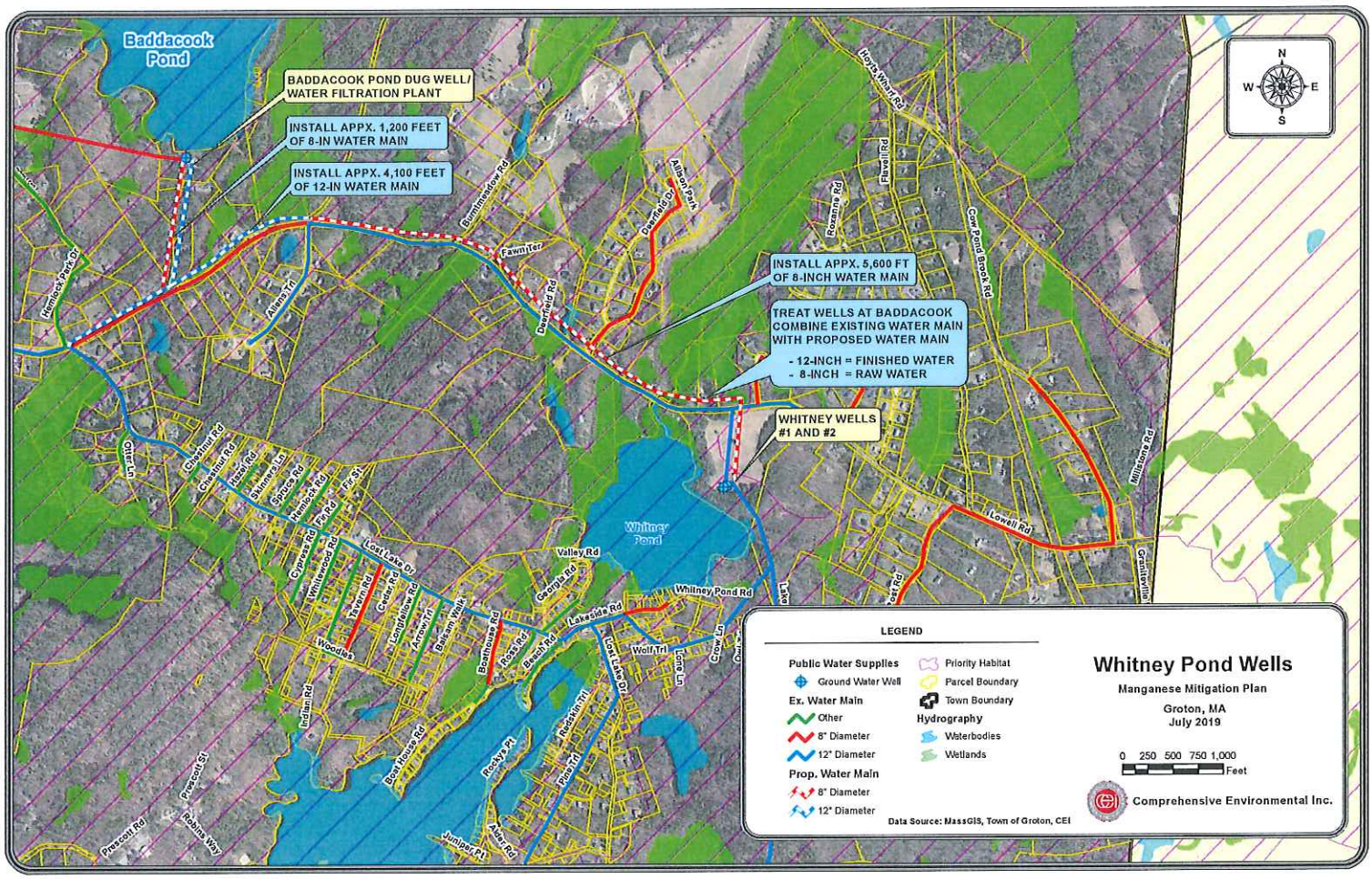
PWS ID#: 2115000	PWS Name: Groton Water Department

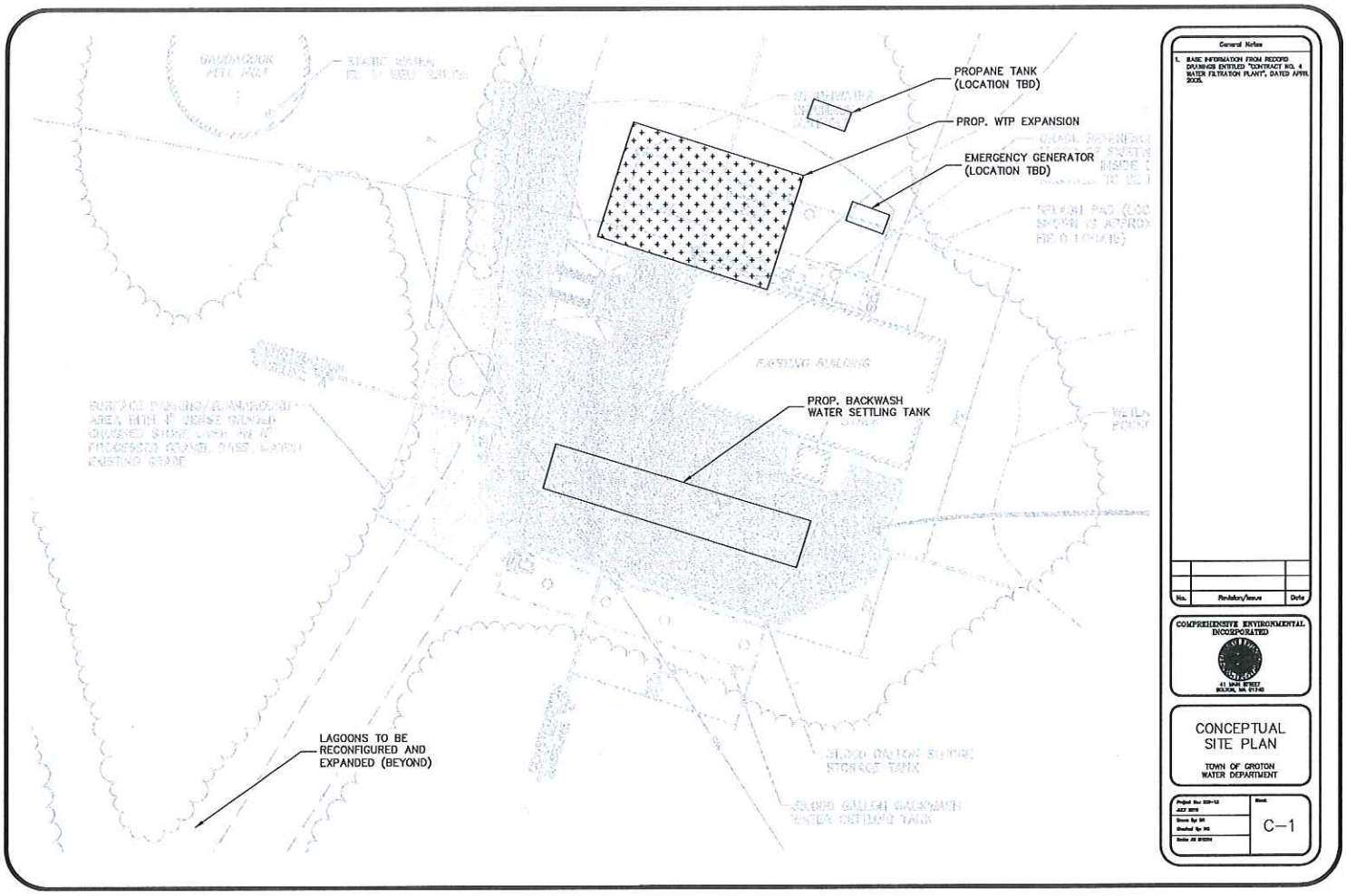
Contact Name: Tom Orcutt	Phone: (978) 448-1122	Email: torcutt@townofgroton.org

- ☑ I would like to schedule a meeting with a MassDEP staff person to discuss my system's plans.
- ☐ I would like to receive a visit from a technical assistance (TA) provider to discuss my system's plans.

FIGURES

- **Figure 1:** Conceptual water main layout of selected alternative.
- **Figure 2:** Conceptual site plan of selective alternative.
- **Figure 3:** Conceptual facility layout of selected alternative
- **Figure 4:** Proposed milestone-based schedule


Baddacook Pond
BADDACOOK POND DUG WELL/ WATER FILTRATION PLANT
INSTALL APPX. 1,200 FEET OF 8-IN WATER MAIN
INSTALL APPX. 4,100 FEET OF 12-IN WATER MAIN
INSTALL APPX. 5,600 FT OF 8-INCH WATER MAIN
TREAT WELLS AT BADDACOOK COMBINE EXISTING WATER MAIN WITH PROPOSED WATER MAIN
- 12-INCH = FINISHED WATER
- 8-INCH = RAW WATER
WHITNEY WELLS #1 AND #2
N
W
E
S
Whitney Pond
Hemlock Park Dr
Allens Trl
Fawn Trl
Dearfield Dr
Allison Park
Roxanne Rd
Flavell Rd
Cow Pond Brook Rd
Lowell Rd
Hillstone Rd
Granite Ville
Oyster Ln
Chestnut Rd
Hazel Rd
Skinners Ln
Spruce Rd
Hemlock Rd
Fir Rd
Fir St
Cypress Rd
Whitewood Rd
Lost Lake Dr
Tavern Rd
Cedar Rd
Longfellow Rd
Arrowleaf Trl
Balsam Walk
Woodies
Valley Rd
Georgia Rd
Whitney Pond Rd
Lakeside Rd
Boathouse Rd
Boat Rd
Beach Rd
Lost Lake Dr
Wolf Trl
Lone Ln
Crow Ln
Indian Rd
Boat House Rd
Rocky Pt
Radcliffe Trl
Pine Trl
Juniper Pt
Aster Rd
Prescott St
Prescott Rd
Robins Way
LEGEND
Public Water Supplies
Ground Water Well
Ex. Water Main
Other
8" Diameter
12" Diameter
Prop. Water Main
8" Diameter
12" Diameter
Priority Habitat
Parcel Boundary
Town Boundary
Hydrography
Waterbodies
Wetlands
Data Source: MassGIS, Town of Groton, CEI
Whitney Pond Wells
Manganese Mitigation Plan
Groton, MA
July 2019
0 250 500 750 1,000
Feet
Comprehensive Environmental Inc.



General Notes

1. BASE INFORMATION FROM RECORD DRAWINGS ENTITLED "CONTRACT NO. 4 WATER FILTRATION PLANT, DATED APRIL 2003.

No.	Revision/Issue	Date

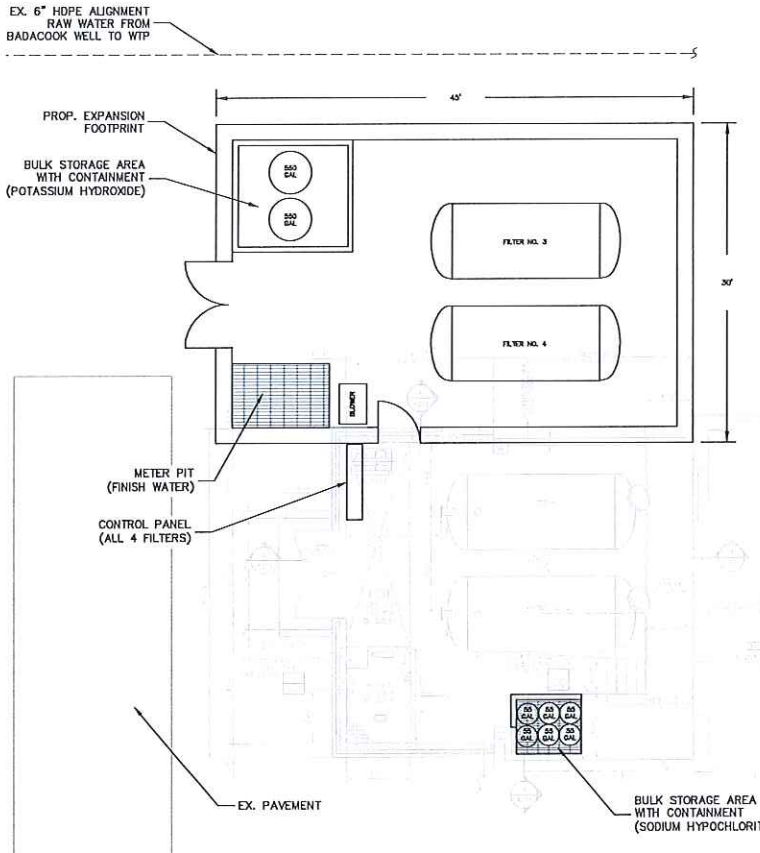
COMPREHENSIVE ENVIRONMENTAL INCORPORATED

41 MAIN STREET
BOLTON, MA 01740

CONCEPTUAL SITE PLAN

TOWN OF GROTON
WATER DEPARTMENT

Sheet
C–1



PRELIMINARY FACILITY SIZING

DESIGN FLOW	
POTENTIAL FLOW FROM BADDACOOK / SHATTUCK WELLS (GPM)	550
POTENTIAL FLOW FROM WHITNEY WELLS (GPM)	750
FACILITY DESIGN FLOW (GPM):	1,300

NOTES:
1. ASSUMES MAX. PUMPING OF BADACOOK (250 GPM) & SHATTUCK (285 GPM)
2. REGISTERED / AUTHORIZED MAXIMUM DAY WITHDRAWAL:
 - BADDACOOK: 0.217 MGD (150 GPM)
 - SHATTUCK: 0.324 MGD (225 GPM)
 - WHITNEY: 0.576 MGD (400 GPM)

FILTER CAPACITY		
SCENARIO	LOADING RATE	
	4 GPM/ SF	7 GPM/ SF
WTP MAX. CAPACITY WITH FOUR (4) FILTERS ONLINE (GPM)	1,600	2,800
WTP MAX. CAPACITY WITH THREE (3) FILTERS ONLINE (GPM)	1,200	2,100
WTP MAX. CAPACITY WITH TWO (2) FILTERS ONLINE (GPM)	800	1,400

NOTES:
1. ASSUMES EACH FILTER HAS APPX. MEDIA SURFACE AREA OF 100 SF (2, 50 SF CELLS)

General Notes

1. BASE INFORMATION FROM RECORD DRAWINGS ENTITLED "CONTRACT NO. 4 WATER FILTRATION PLANT, DATED APRIL 2008.

No.	Revision/Issue	Date

COMPREHENSIVE ENVIRONMENTAL INCORPORATED

41 MAIN STREET
BOLTON, MA 01740

CONCEPTUAL EXPANSION LAYOUT

TOWN OF GROTON
WATER DEPARTMENT

Sheet
C-2

Groton Water Department
Proposed Manganese Corrective Action Schedule (based upon Construction of WTP for Whitney Wells)
PROJECT SCHEDULE
June 25, 2019

Activity	Completion Date
Coordination with MassDEP on Mnaganese Compliance	
Prepare/submit proposed Manganese Compliance Plan to MassDEP	9/1/2019
MassDEP Review of Compliance Plan	12/31/2019
Prepare/submit Final Manganese Compliance Plan to MassDEP	2/1/2020
Manganese Removal Treatment Facility at Whitney Wells	
Prepare Pilot Protocol and Submit to DEP	3/31/2019
Conduct Pilot Testing	6/30/2020
Complete Pilot Study Report and Conceptual Design	12/31/2020
Submit PEF for funding through SRF program	8/31/2020
Draft/Final IUP List issued for SRF program	3/31/2021
Approval of Appropriation at Annual Town Meeting	6/30/2021
Design and Preparation of Bid Documents	9/30/2021
Submit Application to SRF program (incl. bid documents)	10/15/2021
SRF program Issues Permission to Advertise/Bid	12/31/2021
Pre-qualification	3/31/2022
Bid Period (Filed Sub-bids and General Bids)	6/30/2022
Review/Evaluate of General Bids	7/31/2022
Submit Part B to MassDEP for DWSRF	9/30/2022
DWSRF Program Review & Approval to Award	12/31/2022
Project Award / Execution of Construction Contract	3/31/2023
Construction of Manganese Removal Treatment Facility	9/31/2024
Facility Startup and Testing	11/30/2024
Final Inspection (Building Inspector and MassDEP)	12/31/2024
Manganese Treatment Facility Online	12/31/2024