Merrimack River Water Treatment Facility Sustains Manchester with an Eye on PFAS

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Regulations and Water Quality

Table: Primary Drinking Water Standards

Primary Drinking Water Standards		
Parameter	RCW Water Quality Data	EPA Primary MCL
Antimony, mg/L	ND (< 0.001)	0.006
Arsenic, mg/L	ND (< 0.001)	0.01
Barium, mg/L	0.0085	2
Beryllium, mg/L	ND (< 0.001)	0.004
Cadmium, mg/L	ND (< 0.001)	0.005
Chromium, mg/L	ND (< 0.001)	0.1
Copper, mg/L	ND (< 0.0001)	1.3
Mercury, mg/L	ND (< 0.0001)	0.002
Selenium, mg/L	ND (< 0.001)	0.05
Silver, mg/L	ND (< 0.001)	0.1
Mercury, mg/L	ND (< 0.0001)	0.002
Selenium, mg/L	ND (< 0.001)	0.05
Silver, mg/L	ND (< 0.001)	0.1
Thallium, mg/L	ND (< 0.001)	0.002
Uranium, µg/L	0.2	30
Gross Alpha, pCi/L	2.1	15
Zinc, mg/L	ND (< 0.005)	5
Nitrite-N, mg/L	ND (<0.5)	1
Nitrate, mg/L	ND (<0.5)	10
Total Cyanide, mg/L	ND (<0.02)	0.2

Table: Secondary Drinking Water Standards

Secondary Drinking Water Standards		
Parameter	RCW Water Quality Data	EPA Secondary MCL
Aluminum, mg/L	ND (< 0.05)	0.05
Copper, mg/L	ND (< 0.0001)	1
Iron, mg/L	0.094	0.3
Manganese, mg/L	0.12	0.05
Dissolved Solids, mg/L	160	500
Fluoride, mg/L	ND (<0.1)	2
Sulfate, mg/L	7.1	250
Chloride, mg/L	73	250
Color, PtCo	ND (<5)	15
Odor, TON	< 1	3
pH, su	6.07	6.5-8.5

Table: PFAS Regulations

NHDES PFAS Regulations		
Parameter	Result	NHDES MCL
PFOA, ng/L	ND (< 4.41)	12
PFOS, ng/L	ND (< 4.41)	15
PFHxS	ND (< 4.36)	18
PFNA	ND (< 4.36)	11

- Manganese is the contaminant of concern in the source water.

Intake

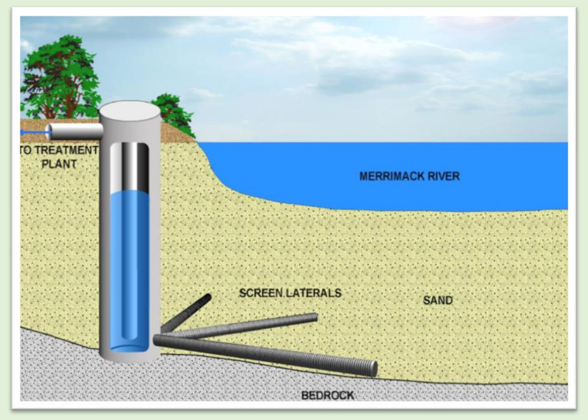

Figure: Riverbank Filtration


Figure: Inside The Radial Collector Well

- Sodium carbonate will be added on the intake pump to the facility to increase the pH of the water prior to treatment.

Oxidation and Filtration

- To aid in filtering out manganese, sodium hypochlorite will be added.
- For filtration, 8 12-foot diameter horizontal pressure vessels with 30-inches of Greensand Plus media inside each, will be implemented.

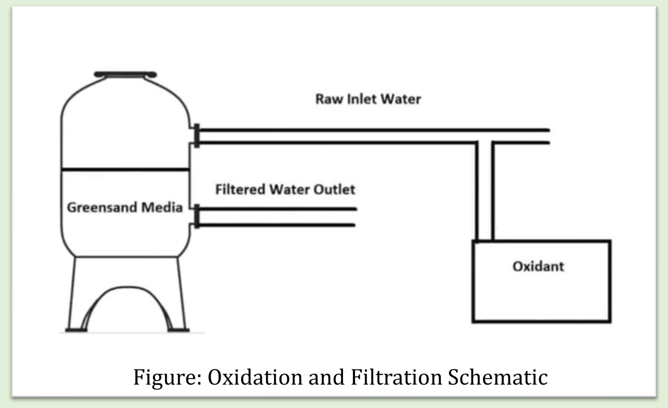

Figure: Oxidation and Filtration Schematic


Figure: Horizontal Pressure Vessels

Backwash Water Recycling

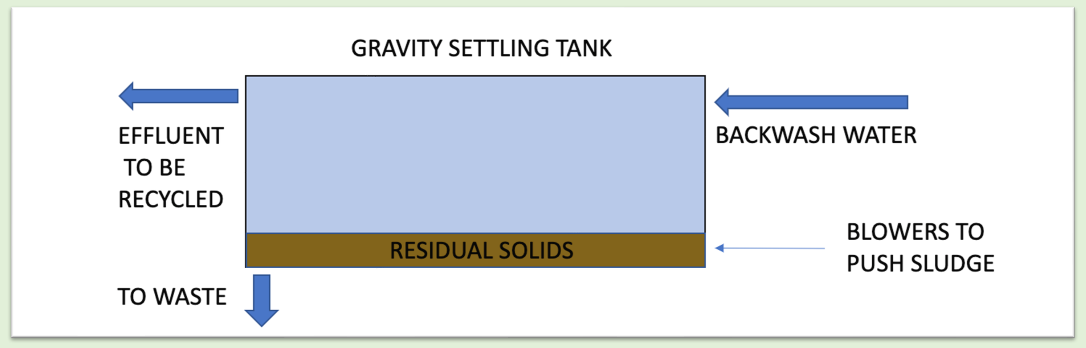

Figure: Sedimentation Basin Design

Treatment Process

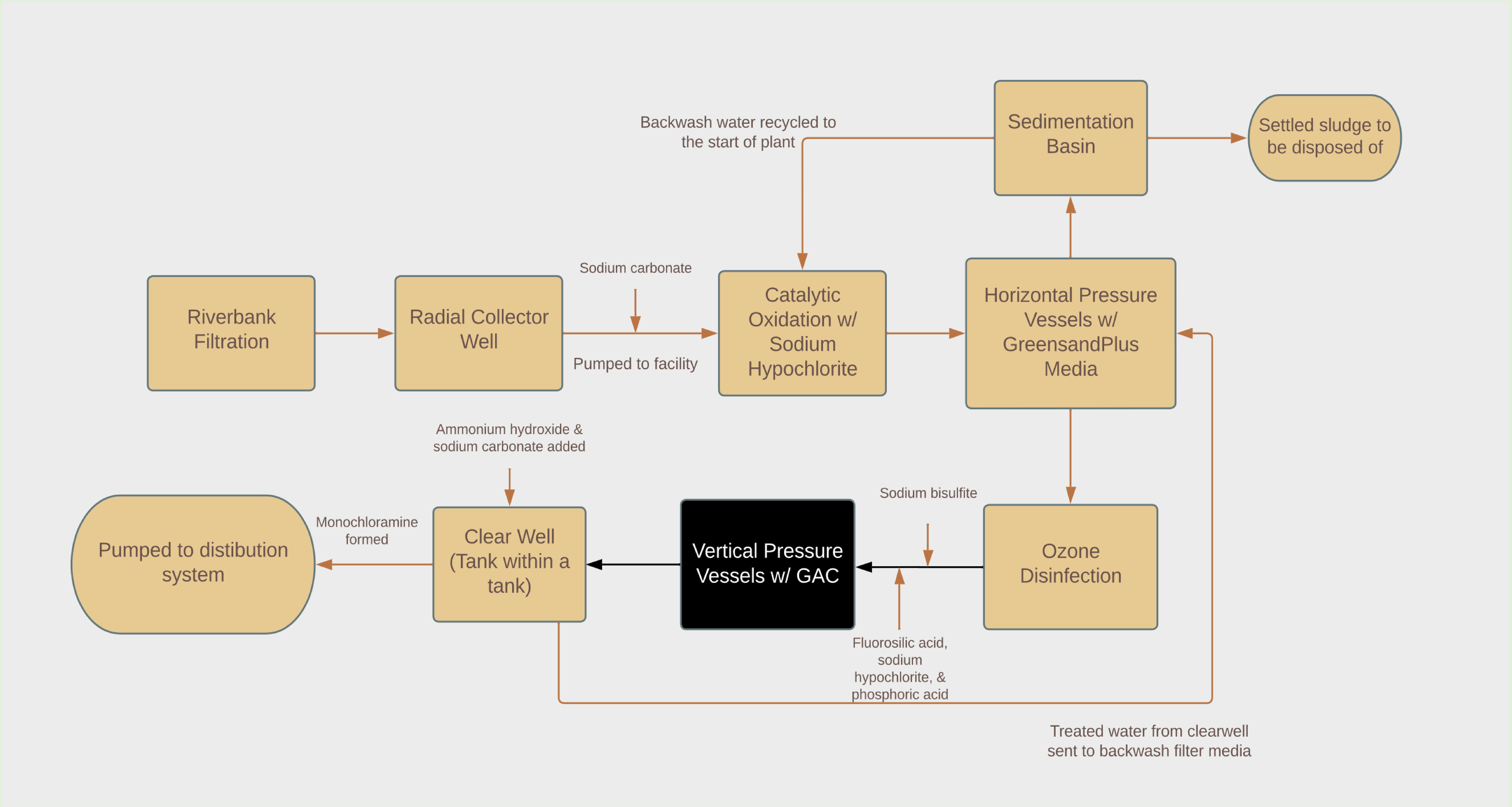

Figure: Conceptual Process Flow Diagram for the Proposed Merrimack River Treatment Facility

Sustainability

Lake Massabesic, the current source water for Manchester, will soon be inadequate as the sole supply, as the water level has been observably decreasing. To increase the readily available and safe drinking water supply to the area, Manchester Water Works has developed a plan to design an additional water treatment facility on the Merrimack River in Hooksett, New Hampshire. The treated water must be indistinguishable from that of Massabesic as they will inevitably mix within the distribution system.

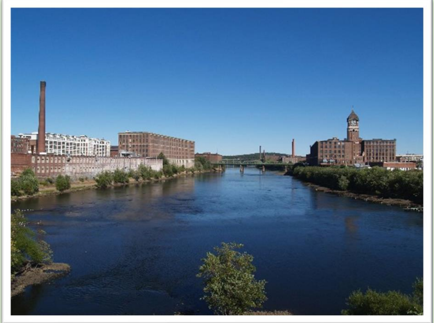
Figure: Merrimack River

PFAS

Given the tightening regulations and the possibility of PFAS being detected in the source water in the future, additional treatment provisions have been made in the facility. For precaution, extra space will be provided to implement adequate treatment for PFAS. Granular Activated Carbon (GAC) media within vertical pressure vessels will be used to treat PFAS in the future


Figure: Model 12-40 GAC Vessels

Layout of Facility

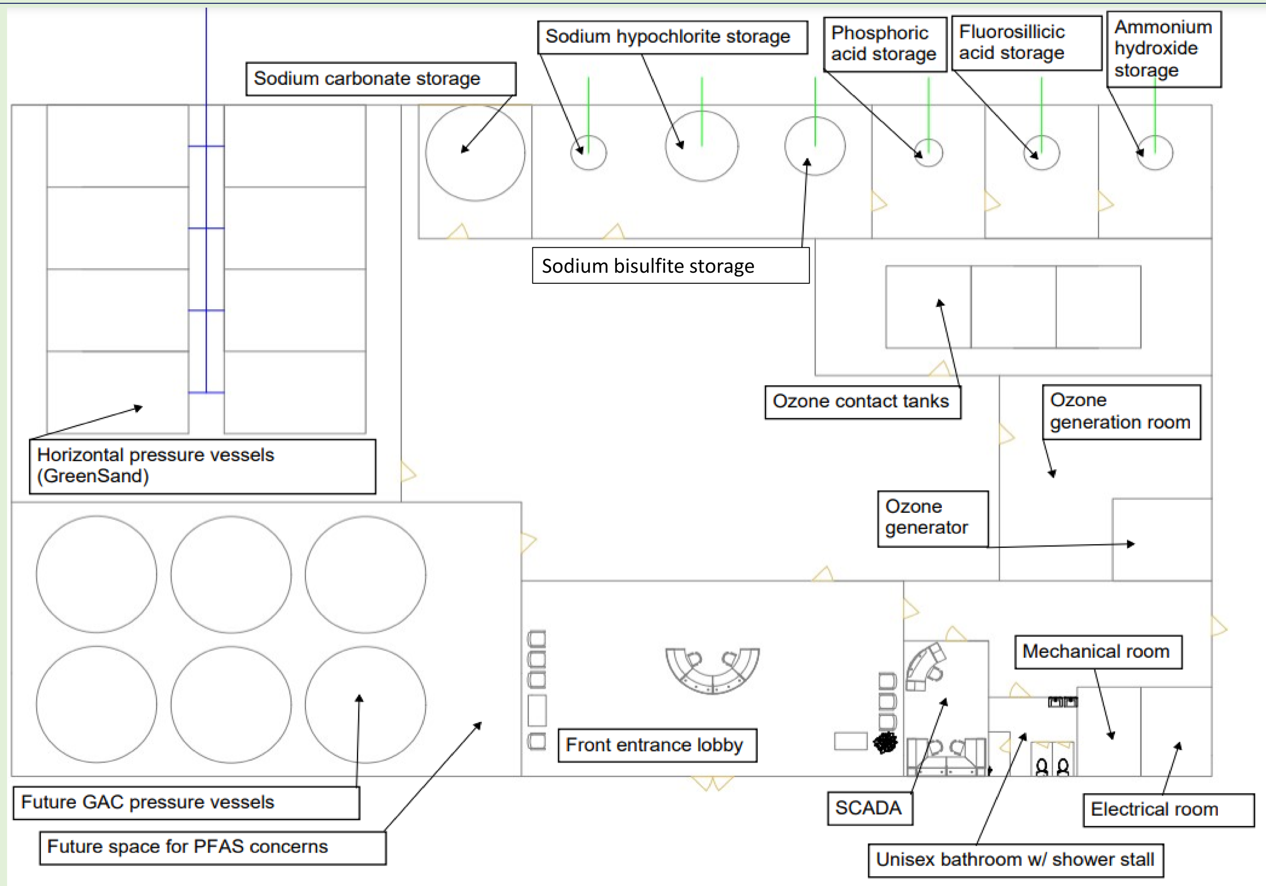

Figure: Indoor Layout

Process	Size (sq. ft)
8 horizontal filtration vessels (Room)	1920 (3,190)
Backwash + sludge recovery	248
Ozone generator room and ozone contact tank room	2,020
Sodium bisulfite storage (Room, stored with sodium hypochlorite)	56.7 (936)
Sodium hypochlorite storage including catalytic oxidation and monochloramine formation needs with separate tanks (Room, stored with sodium bisulfate)	25 for catalytic oxidation 106 for monochloramine formation (936)
Sodium carbonate storage (Room)	148.5 (312)
Phosphoric acid storage (Room)	16 (312)
Fluorosilicic acid storage (Room)	25 (312)
Ammonium hydroxide storage (Room)	25 (312)
PFAS future additions, 6 vertical vessels (Room)	1,700 (2,664)
Clear well	2,000
Restroom	106.25
SCADA Room	201
Mechanical Room	90
Electrical Room	100
TOTAL:	16,102.5

Disinfection


Figure: Ozone Contact Tanks

- Ozonation
- Three 25,000-gallon tanks with a 10-minute contact time.
- Sodium bisulfite added to quench the dissolved ozone in the treated water.

Fluoride and Corrosion Control

- Fluorosilicic acid will be used for dental protection.
- Phosphoric acid will be used for corrosion control protection in the distribution system.


Figure: Corroded Piping

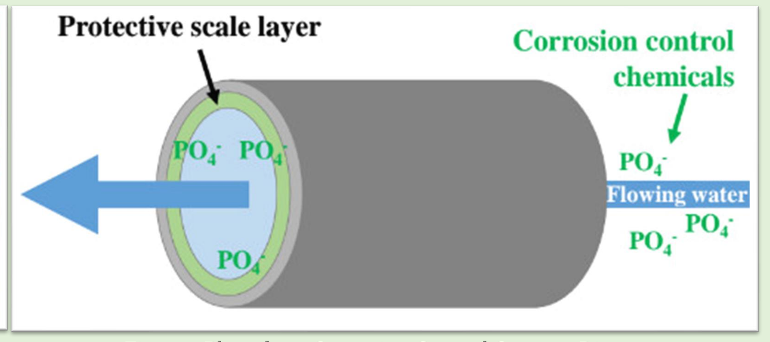

Figure: Phosphate Corrosion Control Concept Diagram

Distribution

- One clear well to store filtered water and act as a reserve for backwash.
- Treated water will enter the distribution system to be mixed with treated Lake Massabesic water and utilized by the Manchester residents


Figure: Tank-within-tank Clearwell Design

Comparison Between MRWTF & LMWTF

Table: Comparison between MRWTF and LMWTF

	Lake Massabesic Water Treatment Facility	Proposed Merrimack River Water Treatment Facility
Source	Surface	Surface + Groundwater
Turbidity upon intake	Conventional methods (coagulation, flocculation, sedimentation)	Riverbank filtration and radial collection
Filtration media	Granular activated carbon in vertical pressure vessels	GreensandPlus in horizontal pressure vessels
CECs	PFAS	PFAS
Disinfection method	Ozonation with free chlorine	Ozonation
Secondary disinfection	Chloramines	Chloramines
Fluoridation	Fluorosilicic acid	Fluorosilicic acid
Corrosion control	Phosphoric acid	Phosphoric acid

Preliminary Cost Estimates

- Accounting for turnkey construction and installation:
- $8 million to $9 million would be required for treatment **without** PFAS additions
- $10 million to $11 million would be required for treatment **including** PFAS additions

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