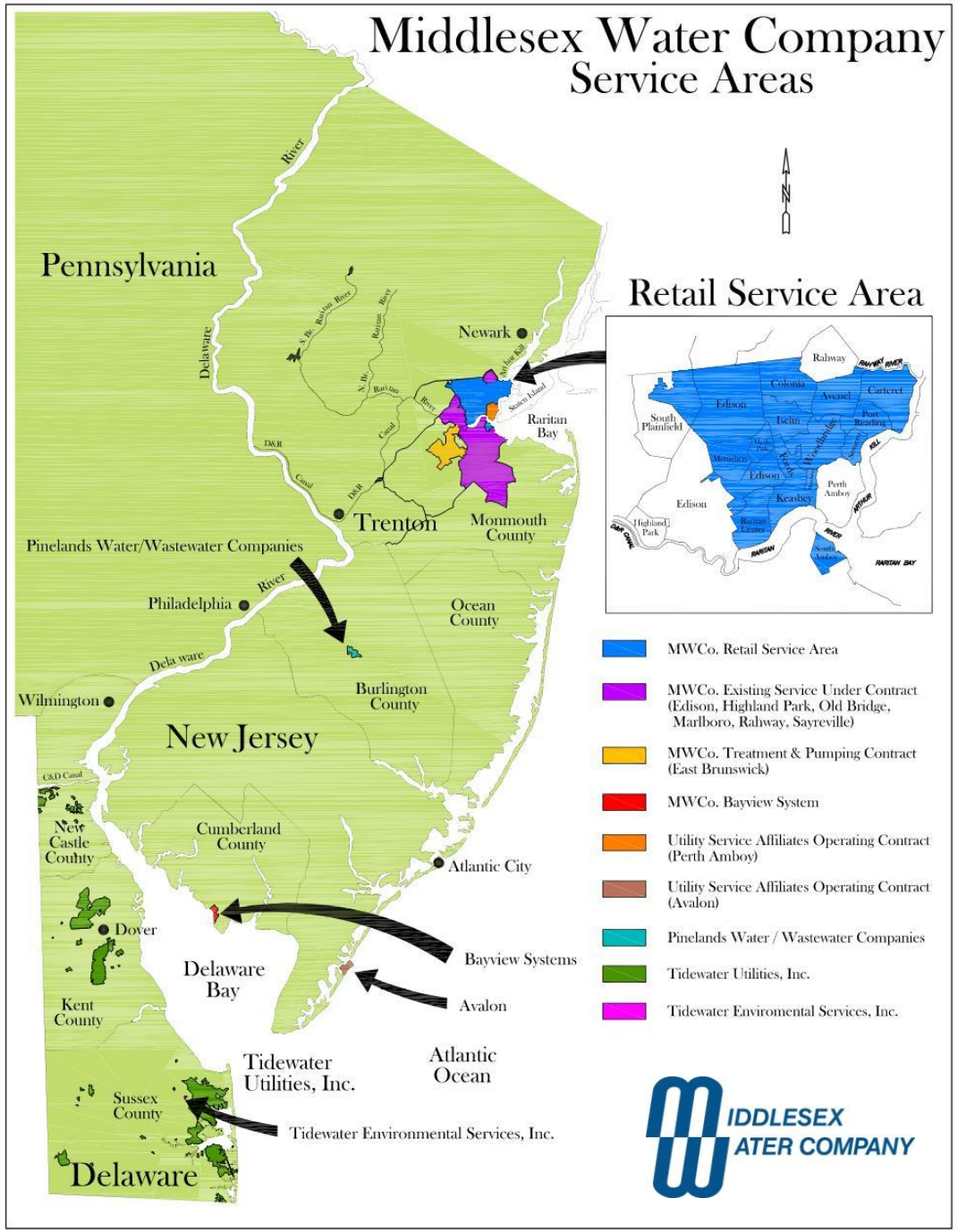
Middlesex Water Company

- Incorporated as a private water utility in central NJ in 1897
- Provides water, wastewater and related utility services in central New Jersey and Delaware
- Serves a population of more than 450,000

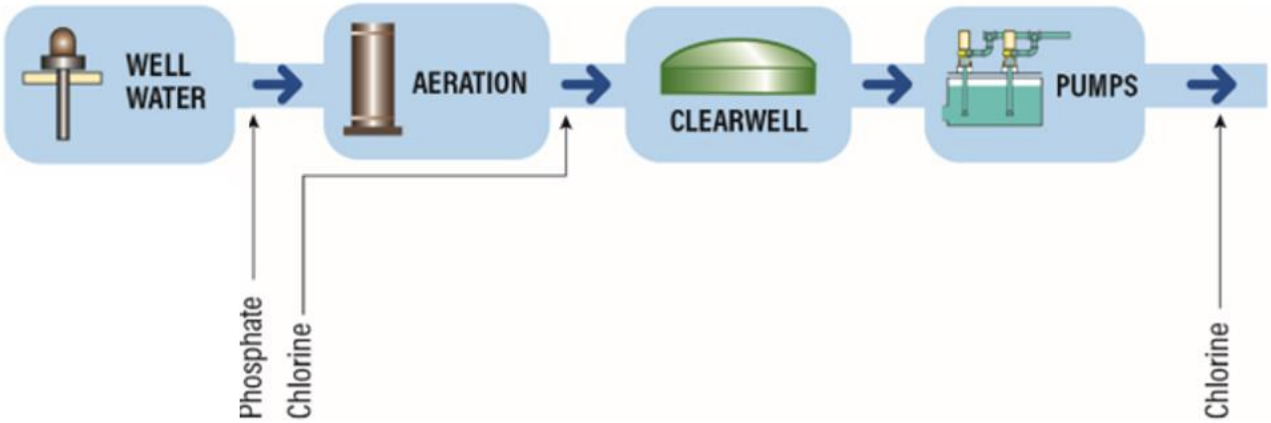
Service Area

- Eastern Middlesex County, New Jersey
- Retail service area
  - Mix of residential customers, large industrial customers, commercial and light industrial facilities
- Water is treated, stored and distributed for residential, commercial, industrial and fire prevention purposes
- Water Sources
  - Carl J. Olsen Water Treatment Plant (surface water)
  - Park Avenue Water Treatment Plant (groundwater)



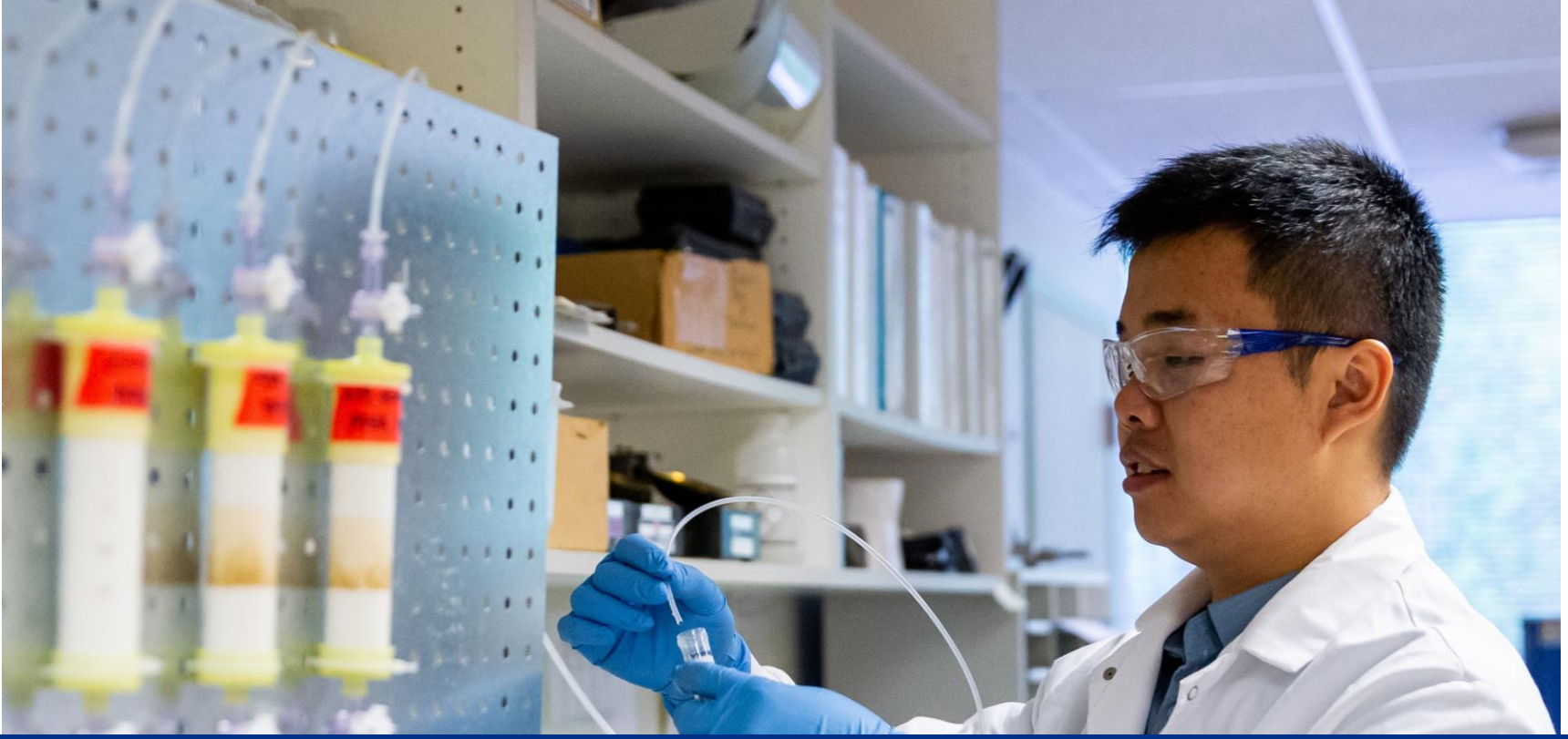
A Brief History of the Park Ave WTP

- Original water source
- 18 Wells
- 16 mgd rated capacity
- Central Treatment Facility
  - VOC (PCE and TCE) treatment
  - Hardness sequestration
  - Disinfection via gas chlorine
  - 5 FW pumps
- 2 MG FW storage tank



Time for more treatment…

- UCMR 3 sample results
  - PFNA = ND
  - PFOS < NJDEP recommended MCL of 13 ng/l
  - PFOA > NJDEP recommended MCL of 14 ng/L
  - Other short and long-chain PFAS compounds



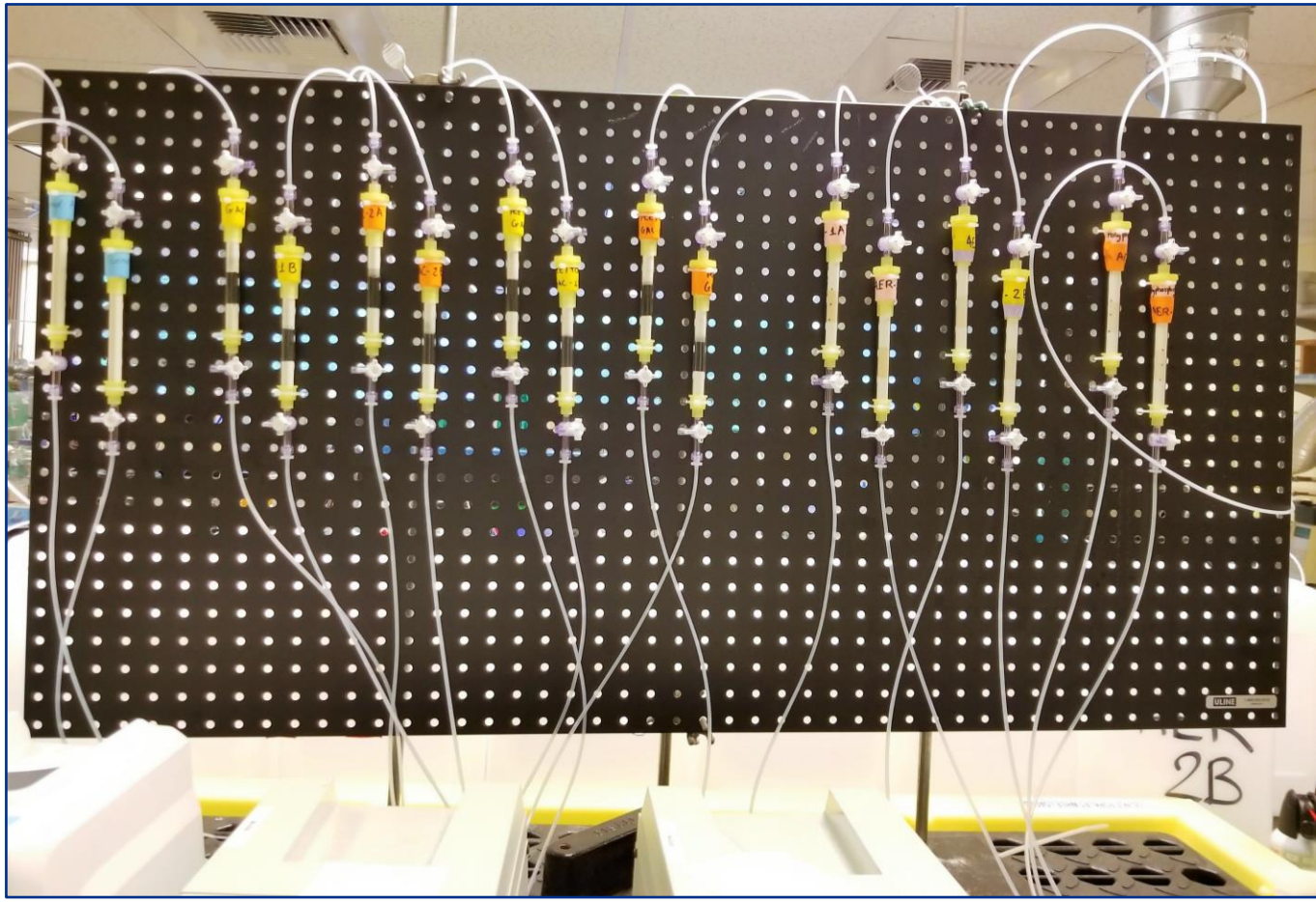
Pilot Testing

Treatment Alternatives

Criteria	Granular Activated Carbon	Anion Exchange	Reverse Osmosis
Effectiveness at Removing Target Compounds			
Impact to Corrosion Control			
Removing Other Contaminants of Emerging Concerns			
Ease of Remote O&M			
Disposal Requirements			
Capital and Operating Costs			

Bench Scale Pilot 2019

- 700 gallons of raw water
- Goals
  - Compare GAC and AIX products
  - Impacts of PCE and TCE
  - Removal of hexavalent chromium
  - Impacts of polyphosphate addition
  - Other



Field Pilot

- 12-month pilot
  - February 2020 to February 2021
- Raw and aerated water
- Evaluate 4 GAC medias
  - PFAS removal efficiency
  - Headloss
  - Media changeout frequency

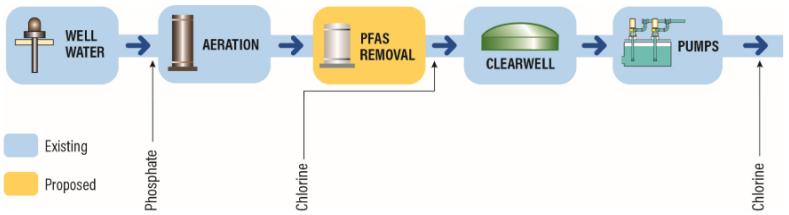
Key Benefit of Field Piloting

- Identified microbiological activity (including a diverse population of algae) causing biofouling

- Was able to be remediated with cartridge filters

Field Pilot Design Impacts

- PFOA driving compound
- Incorporation of 10 µm bag filters (at 60% design)
- No impact on corrosion control
- No increase in arsenic levels during start-up
- Estimated media changeout frequency
- Confirmed location of treatment

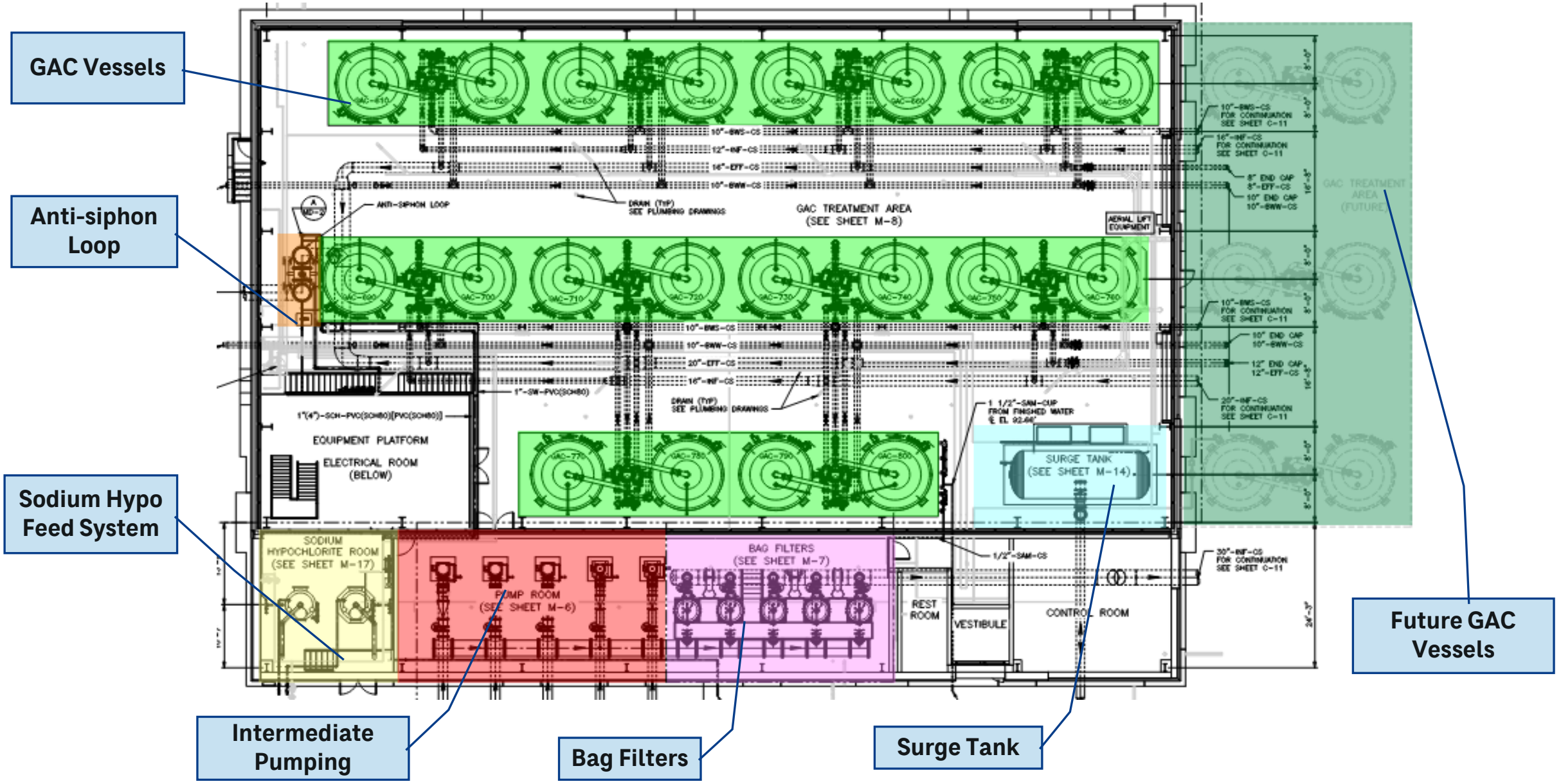


Plan for Treatment

New GAC Facility

- 12 mgd
- 20 GAC vessels
- Intermediate pumping
- 5 bag filters
- Surge tank and site piping
- 200,000 backwash storage tank
- Conversion to sodium hypochlorite
- Ortho/polyphosphate
- Connection to sanitary sewer
- New standby generator

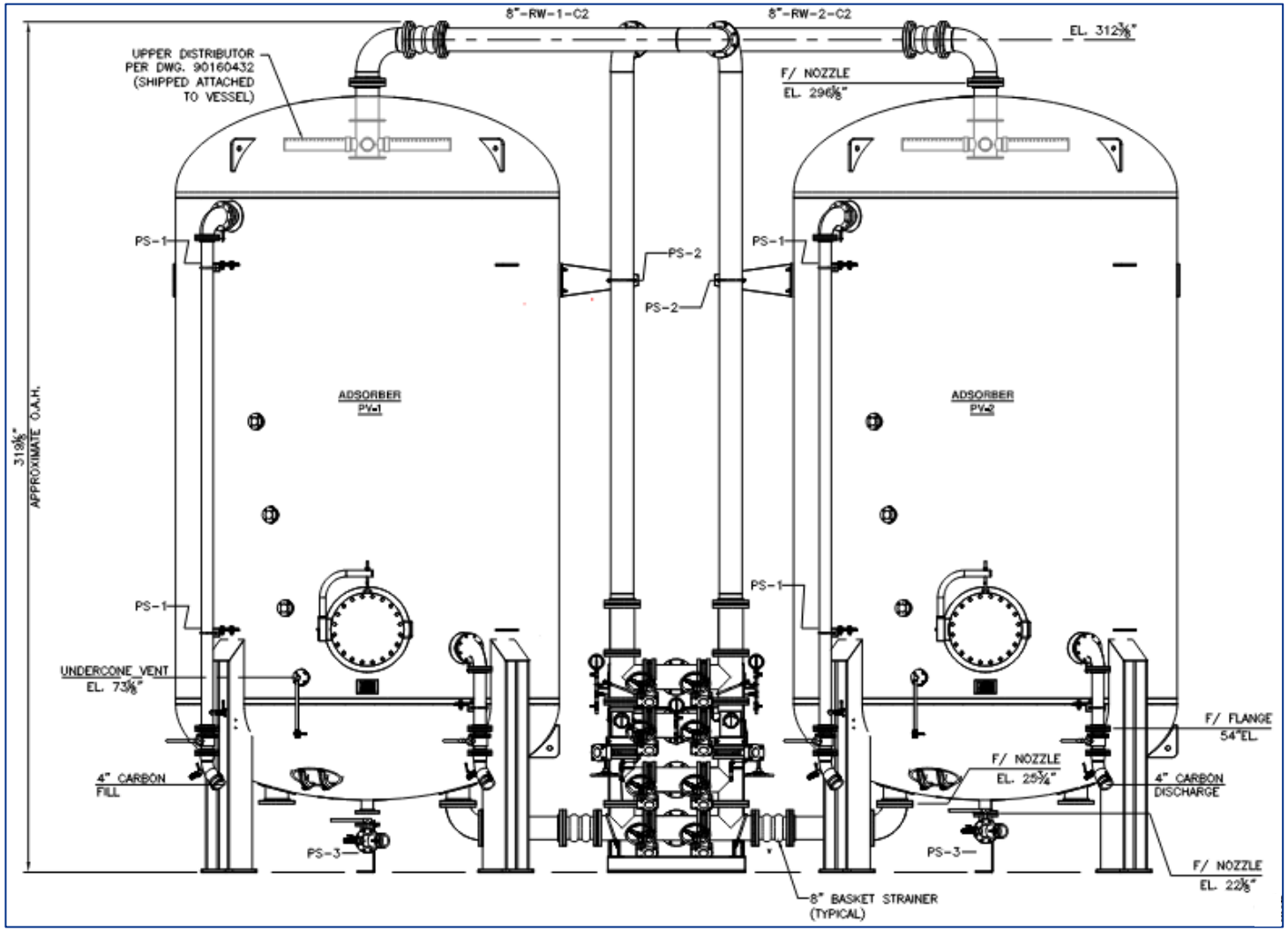
New GAC Facility



Challenges

Mitigating Long Lead Times

- GAC Vessels were pre-procured
  - 10 pairs
  - 12 ft diameter
  - 27 ft heigh
- Bids included all process piping, process valves, and instrumentation for the vessels



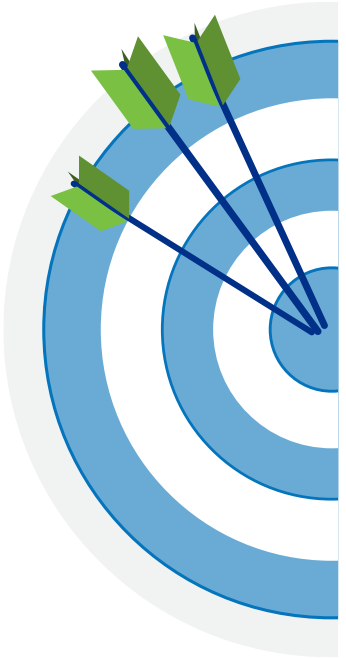
Utility Relocation Needed

- Contract awarded for the relocation of existing utilities at Park Avenue
  - Raw water
  - Finished water
  - Electrical
- Completed in August 2021
- Saved 4 months in up front construction allowing site preparation to start sooner

Unintended Consequences

- Lack of well pumping
- Rise in water levels around site
- Impact to local residents
- Resume operation of wells with a temporary discharge to streams

Specified Water quality Goals

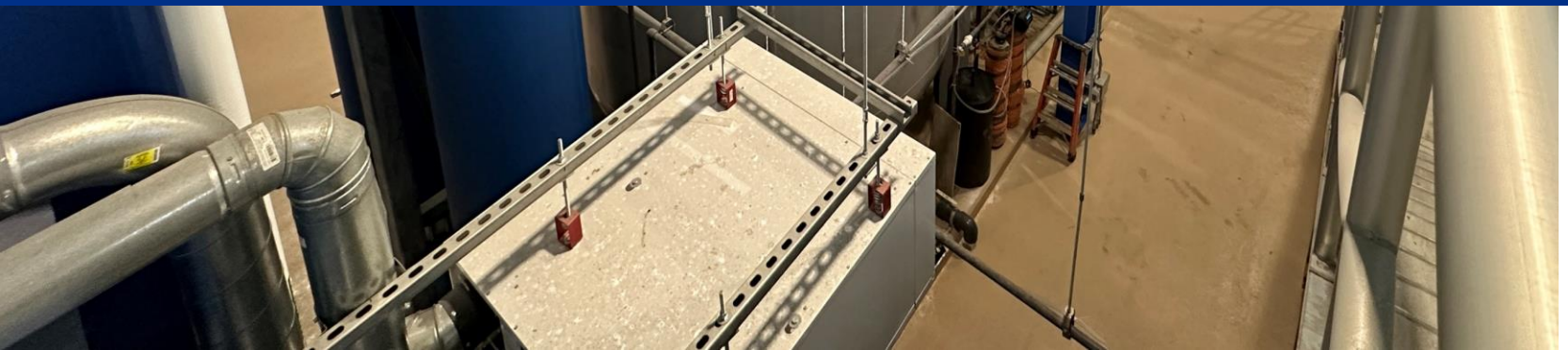


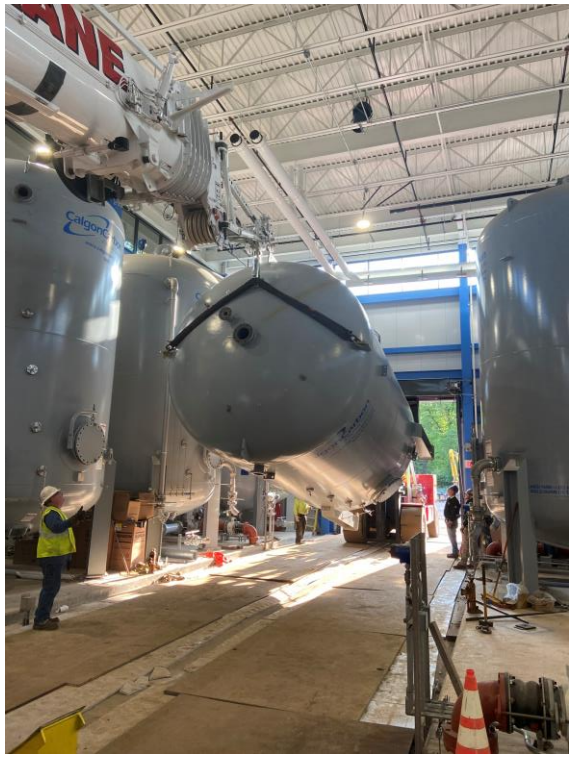
1. Arsenic (total) < 0.0025 mg/L
2. Turbidity < 0.3 NTU
3. pH 7.5 to 8.5

Start-up Challenges

- Anticipated forward flushing: 400,000 gallons (10 BV)
- Actual forward flushing: 4,900,000 gallons (120 BV)
- Limitation of 200,000-gallon backwash tank
- Limitation of sewer discharge

Full Scale Operations




Initial Results

Vessel No.	Driving Compound at Lead Vessel	Total BVs at Changeout
5B	PFOA (2.8)	26,940
6B	PFOA (2.4)	27,190
10B	PFOA (4.9)	26,400

Results After First Media Changeout

Vessel No.	Driving Compound at Lead Vessel	Total BVs at Changeout
5A	PFOA (7.4)	18,461
6A	PFOA (3.9)	16,458
10A	PFOA (6.3)	16,568

Takeaways

- A robust bench scale and field pilot testing program can yield dividends beyond the normal expected goals.
- Pre-procurement of critical components can help mitigate long lead times
- Proceeding with general site work and utility relocation can be performed prior to 100% design
- GAC bed life can vary significantly between lead and lag vessels