Managing PFAS in Industrial Stormwater to Protect Groundwater Quality

NEWEA 2024
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Presented by
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Importance of PFAS Mitigation

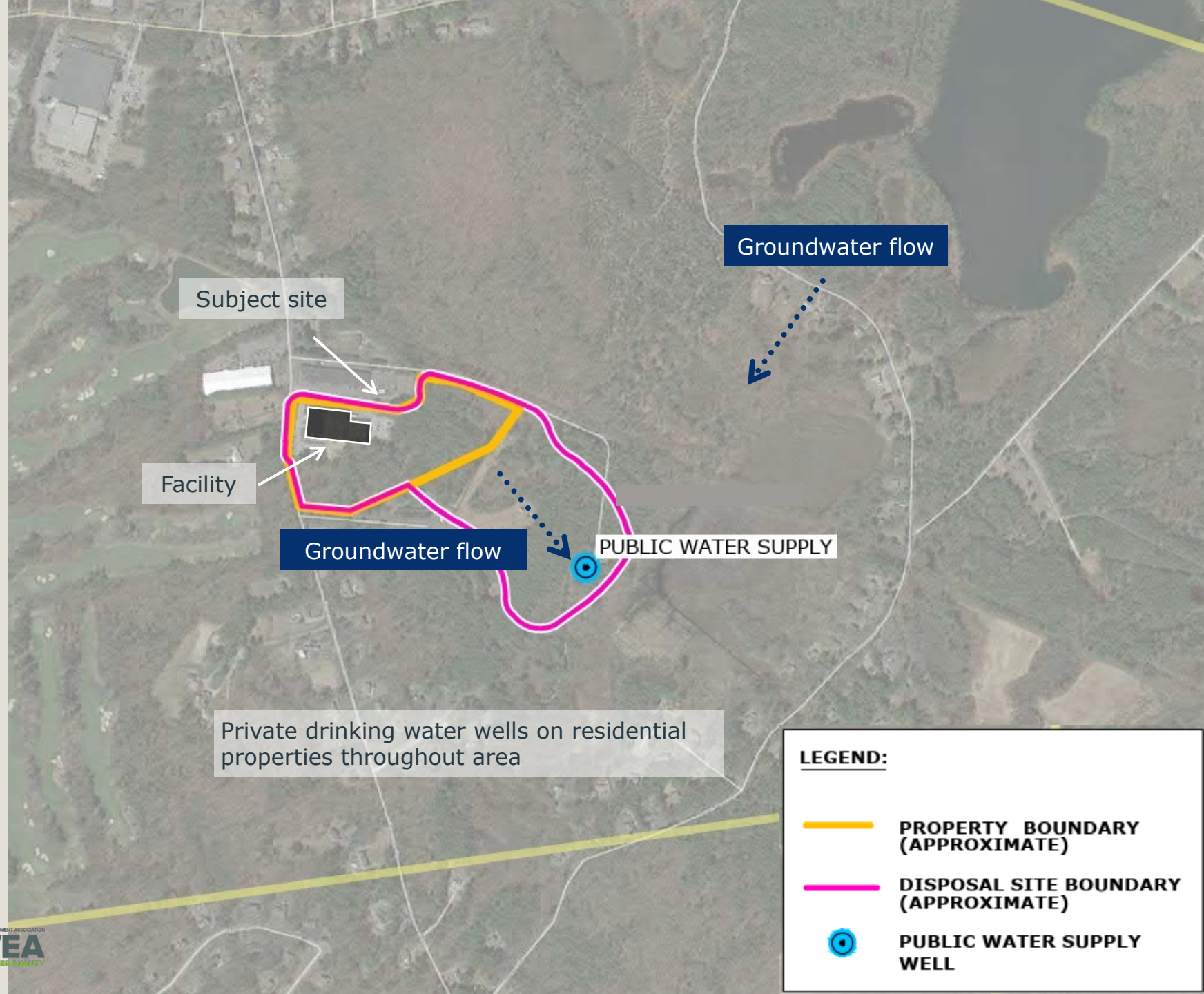
- Industrial facilities that discharge stormwater to surface water are regulated under the Clean Water Act.
- Industrial stormwater has been identified as a potential contributor of PFAS to groundwater or other drinking water supplies; although current regulations around PFAS in industrial stormwater are lacking in most states unless under an individual NPDES Permit.
- This case study is about treating PFAS in industrial stormwater, so what was the driver?
- The state treated the industrial stormwater discharge as a pollutant source to groundwater and regulated the impacted stormwater under the MCP.

Facility Background

- Manual and robotic spray application of fluoropolymer coatings on medical devices in spray booths
- Curing of coatings in infrared and convection-type ovens
- Air emissions from spray booth and oven stacks
- 14 scuppers collect stormwater flow from the roof and previously discharged to ground surface, where it infiltrated into the subsurface or discharged to a surface water body

Site Setting

- Multiple private drinking water wells, a public water supply well and a public surface water supply are located near the Site
- Groundwater flows toward the public water supply and residential private drinking water wells
- Groundwater concentrations are above the regulatory threshold in many locations



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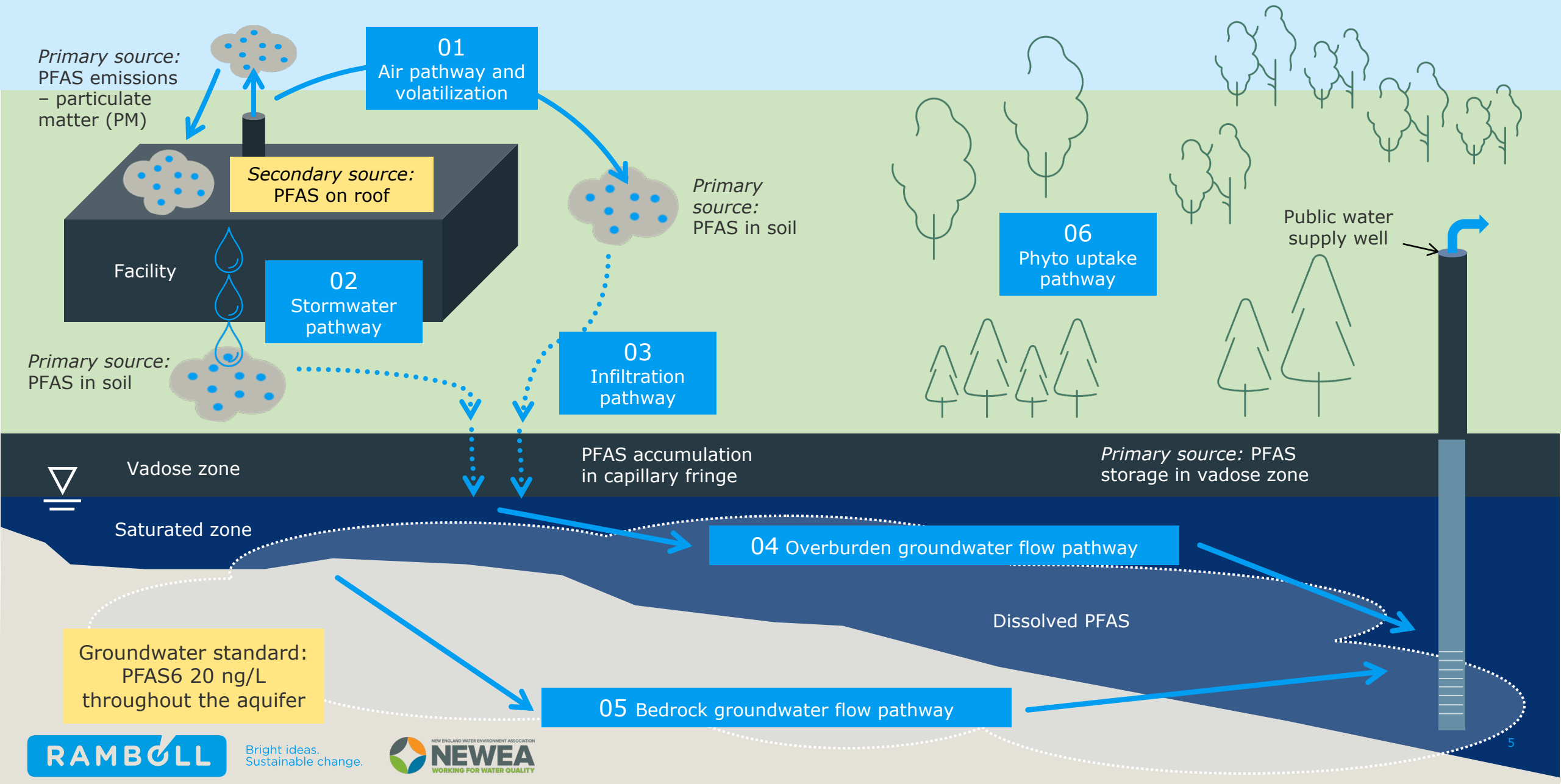
Conceptual site model



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Initial activities to mitigate PFAS in stormwater*

- Multiple lines of evidence investigations
  - Comprehensive testing of materials used in operations
  - Characterization of air emissions
  - Stormwater testing
- PFAS emissions minimized via process improvements
- Impacted materials removed and replaced or cleaned

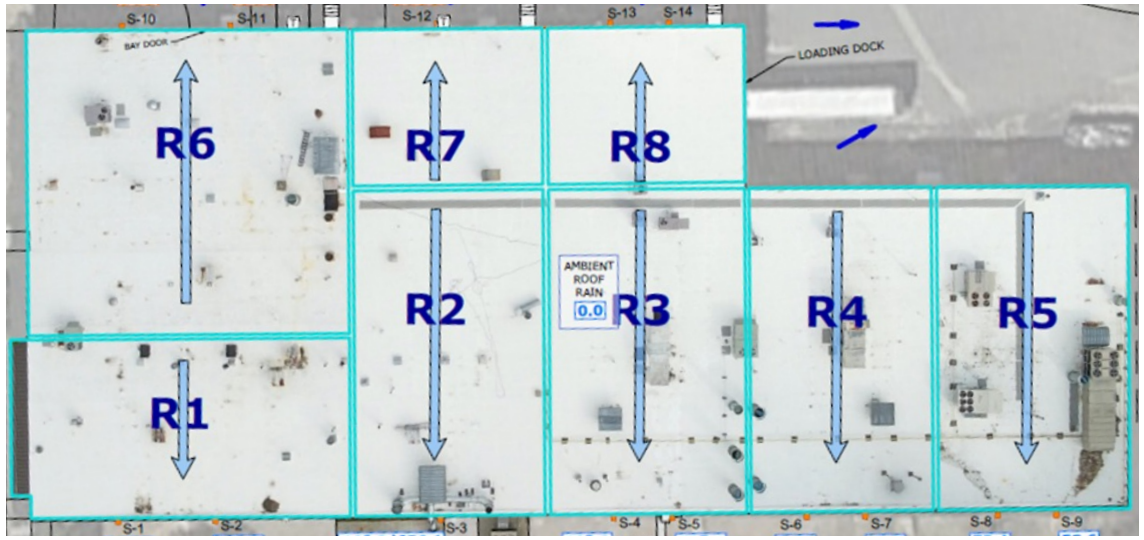
*In this case study, "stormwater" refers to the stormwater runoff from the facility roof

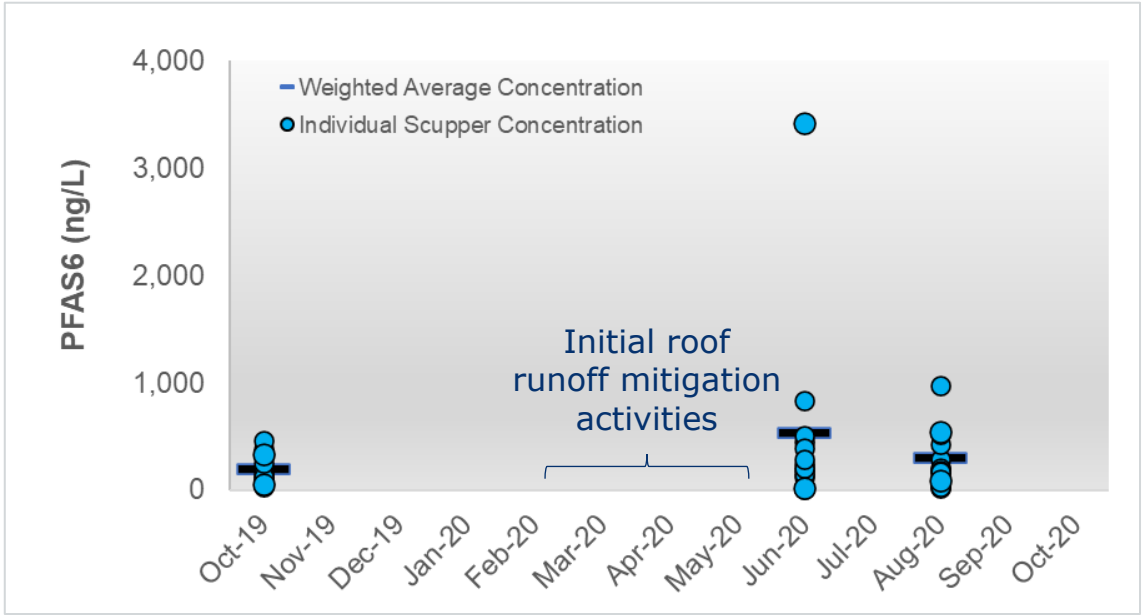

Before roof replacement


After roof replacement

PFAS continue to be detected in stormwater

- Following the mitigation efforts, PFAS continued to be detected in stormwater. Sampling occurred within 30 minutes of first discharge.
  - More than 3,400 ng/L PFAS6 in some individual scuppers
  - Up to 530 ng/L PFAS6 as a weighted average in the roof runoff
- Detections inconsistent with estimated PFAS6 stormwater concentrations based on current air emissions
- Note that leaching from the on-site soils is a more significant source of PFAS6 in groundwater than stormwater





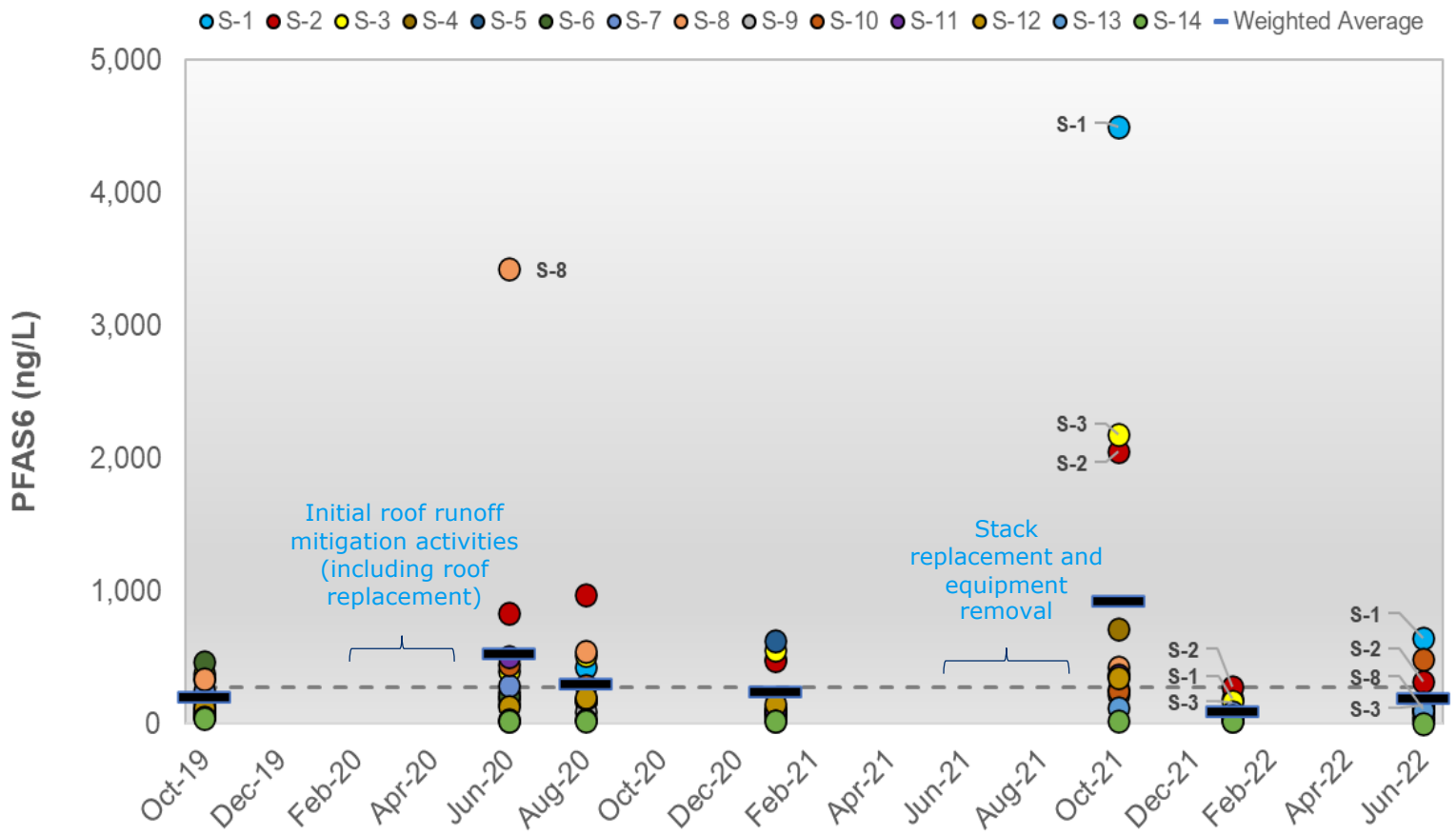
PFAS6 is the sum of PFHpA, PFOA, PFNA, PFDA, PFHxS and PFOS

Prioritization of mitigation activities to reduce PFAS in stormwater

- Results from the comprehensive source investigation were used to prioritize next steps
- Identified and replaced several oven and spray booth stacks and other older equipment

PFAS continued to be detected in the stormwater

- Stormwater weighted average PFAS6 concentrations (blue bars) were below the CSM 275 ng/L threshold following additional mitigation measures. The modeled CSM threshold impacted the vadose zone by <1%
- However, concentrations are variable and periodically exceed that level
- Regulatory agency rejected the CSM 275 ng/L proposed as a discharge standard and required that PFAS6 in stormwater meet the drinking water standard of 20 ng/L
- Uncertainties exist with future regulatory thresholds (concentrations and specific PFAS compounds regulated)



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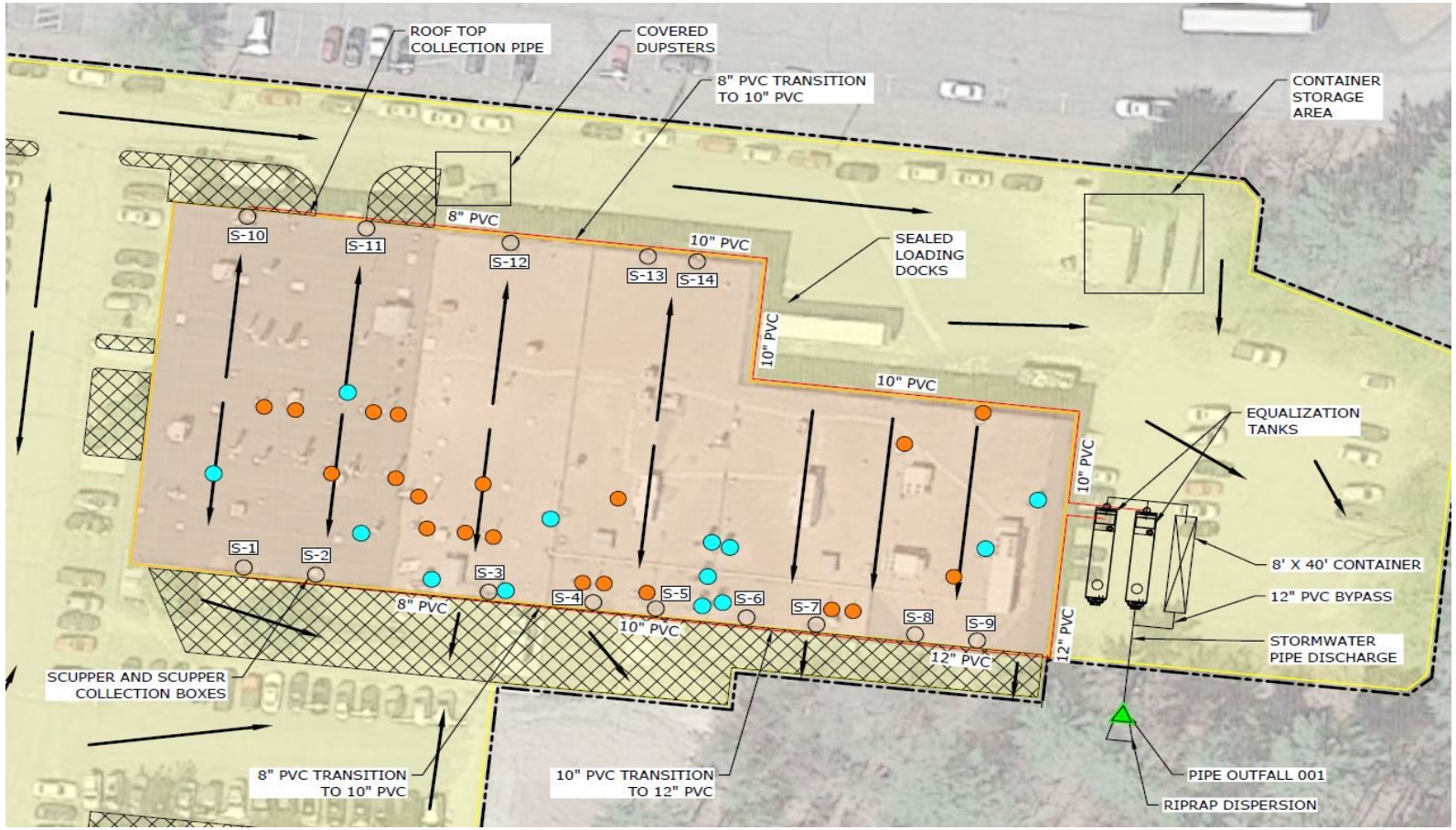
Stormwater treatment for PFAS

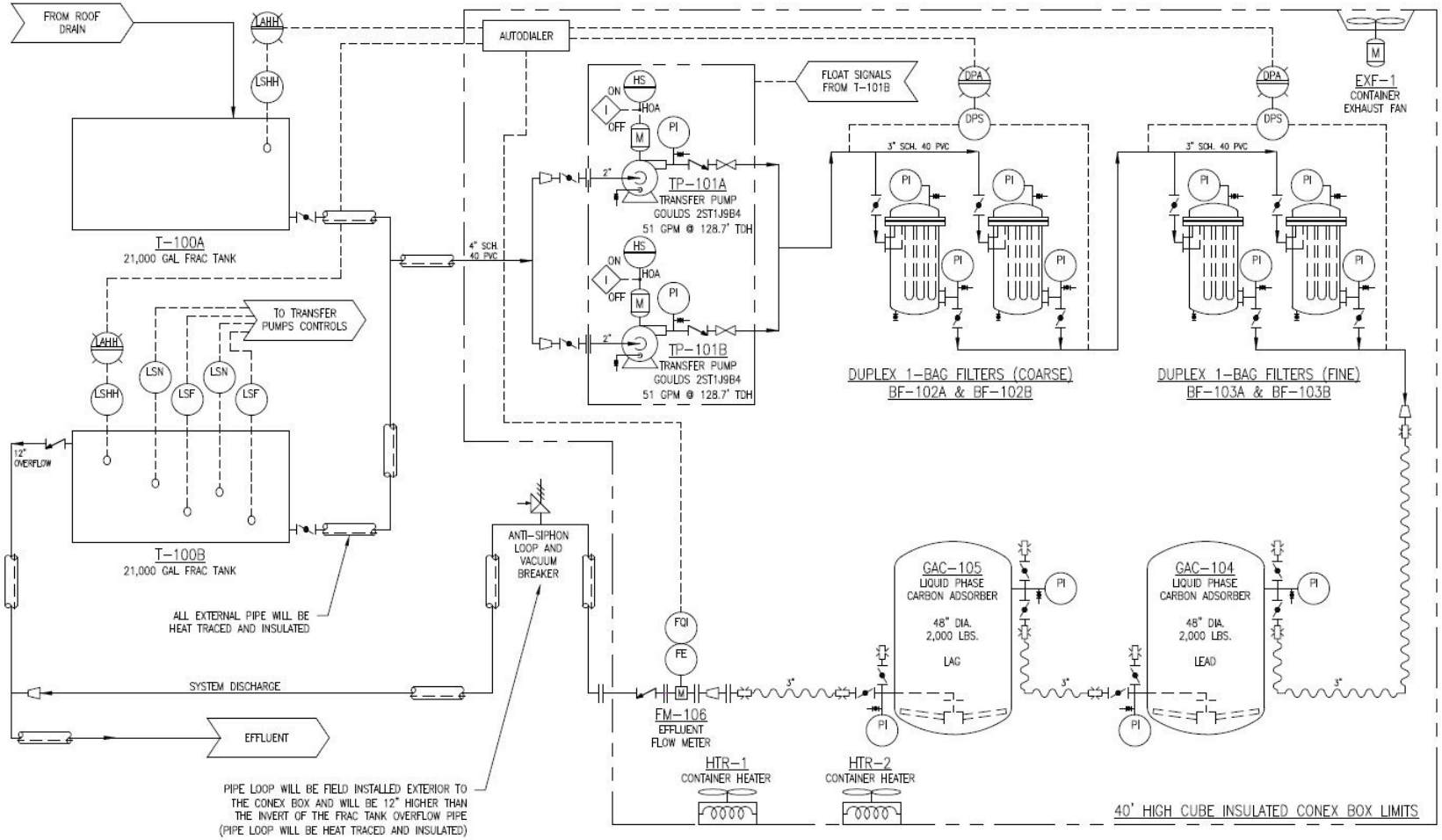
- Stormwater Capture and Treatment (SCTS) using Granular Activated Carbon (GAC) designed to meet the 20 ng/L PFAS6 groundwater standard with these conditions:
  - Influent assumed to range from 200 to 1,000 ng/L of PFAS6 in stormwater
  - State stormwater regulations (Massachusetts Stormwater Handbook and Stormwater Standards) specify treatment of "first flush," i.e., the Water Quality Volume which is the first inch of 24-hour storm (27,500 gallons) within 72 hours.
  - State stormwater regulations also require the collection system to be designed to accommodate up to a 10-year 24-hour storm event flow.
  - Design details include optimizing for storms from ~1.5 inches to 2.5 inches in 24 hours
  - Bypass of excess for larger storm flows
  - Design for flexibility to modify the system to address greater storm flows and additional treatment if necessary

Stormwater treatment details



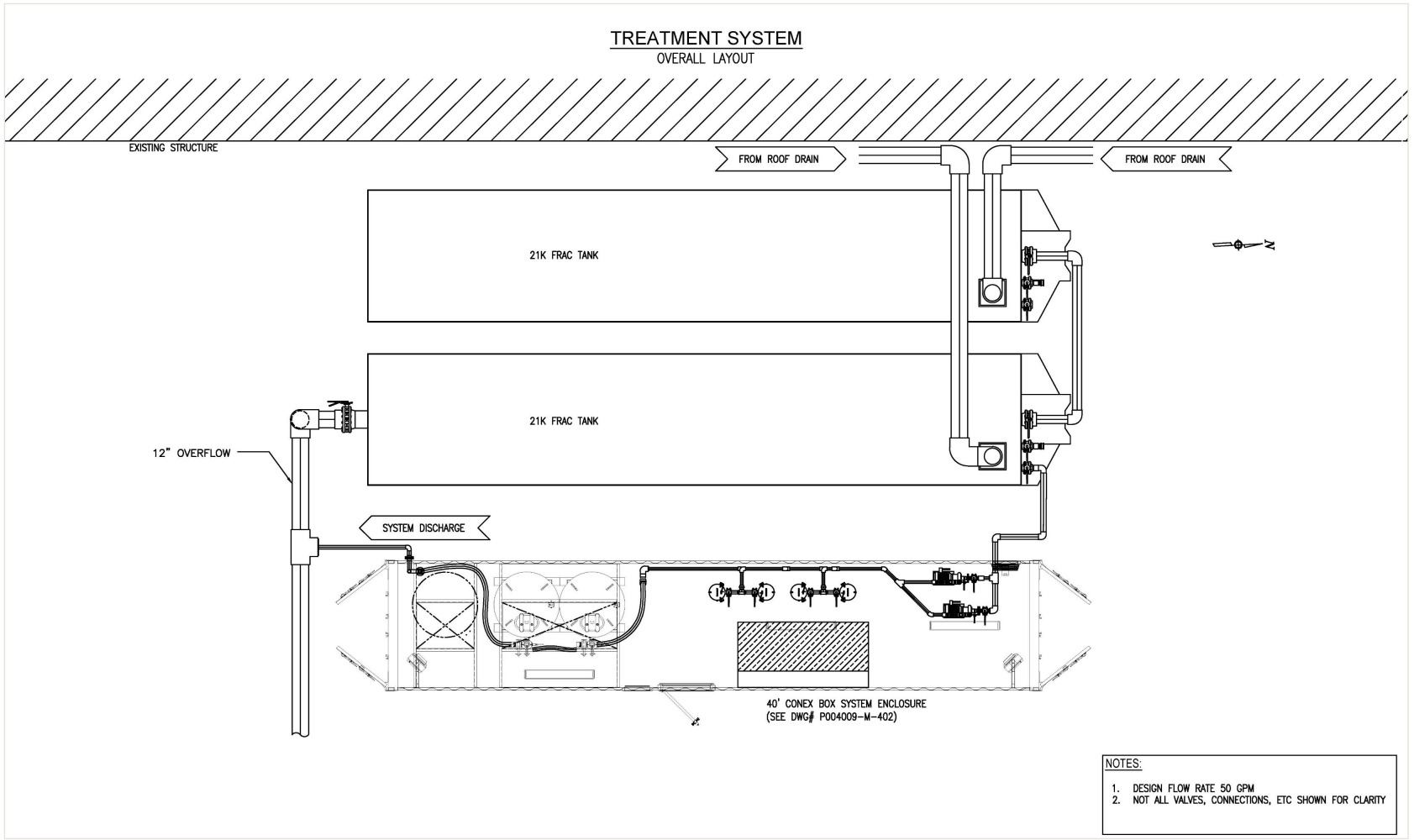
- SCTS Components:
  - Rooftop collection system for stormwater
  - Equalization tanks
  - Particulate filter
  - Two GAC vessels operated in lead/lag mode
- Design treatment flow of 50 gpm (treats the WQV in ~9 hours)
- Discharge of treated stormwater to nearby forested area with riprap dispersion
  - Bypass in the event of large storms

Process flow diagram



- Design uses package units in insulated, heated trailer
- SCTS began start-up at the end of July 2023, on-line shortly after that.

Treatment System Layout



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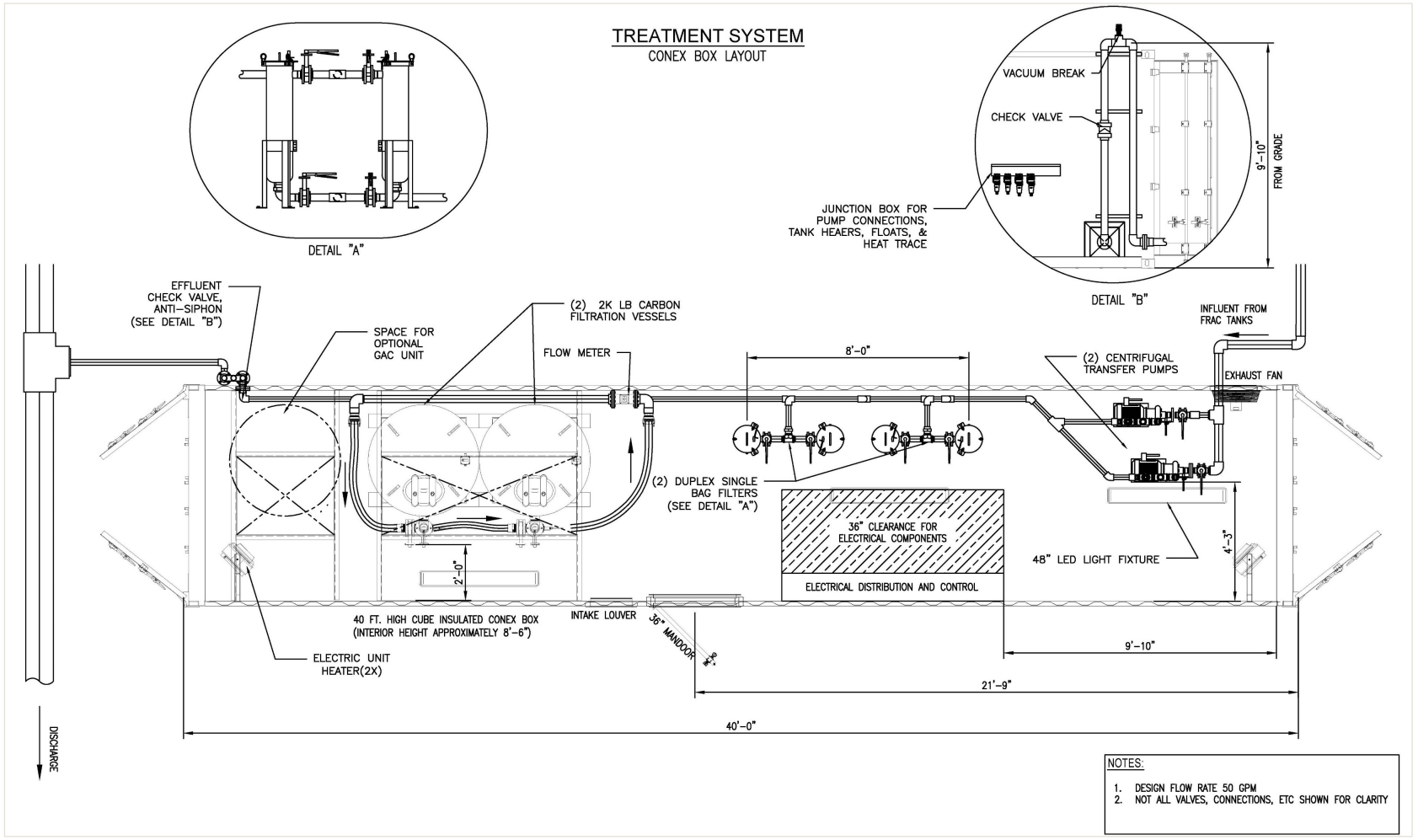

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SCTS Construction Photos

Collection piping, equalization tanks and Conex box with treatment system

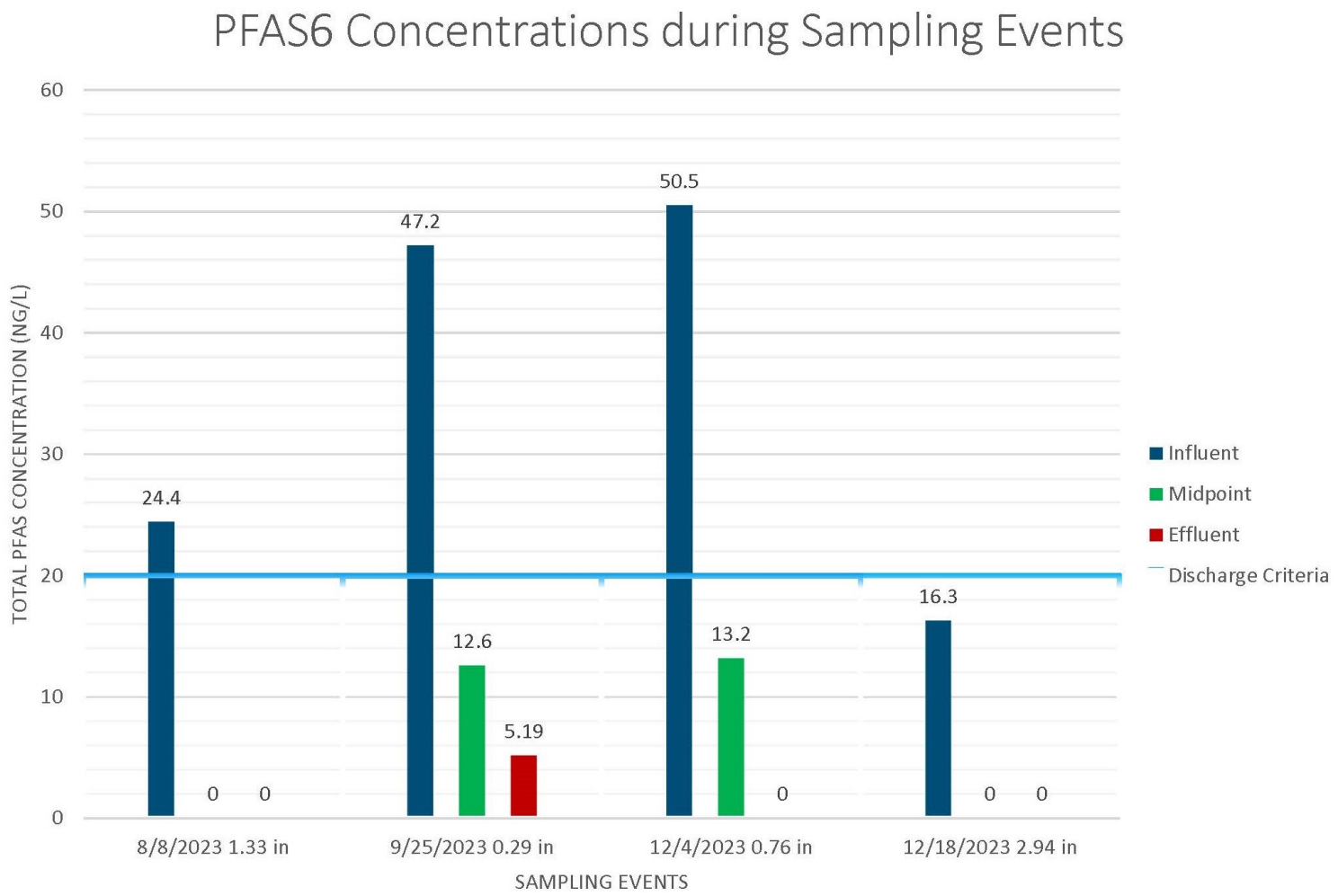

Pumps


Particulate filters


GAC pressure vessels


Treated water and bypass discharge pipes

Performance



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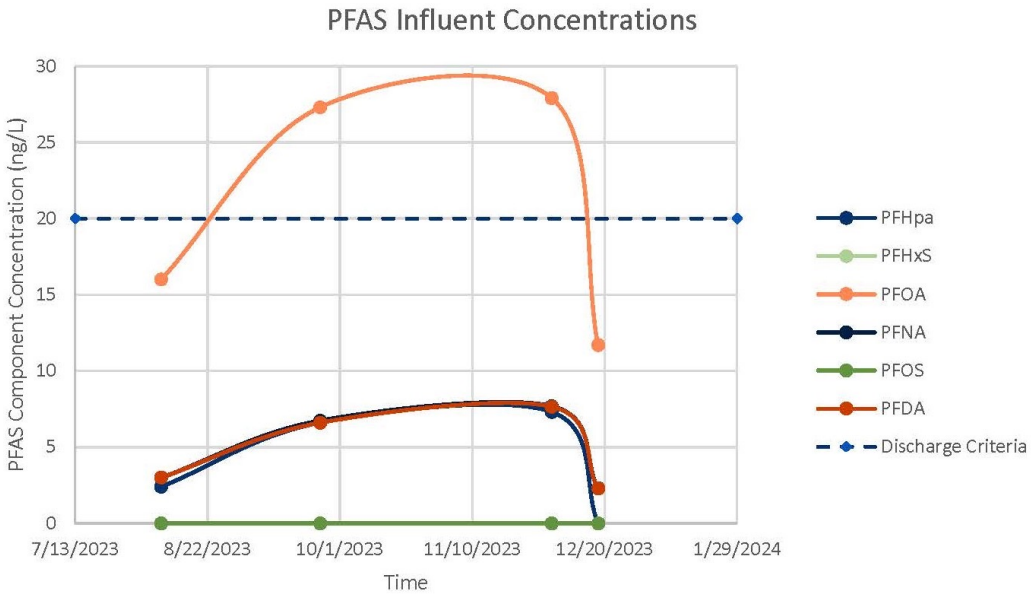

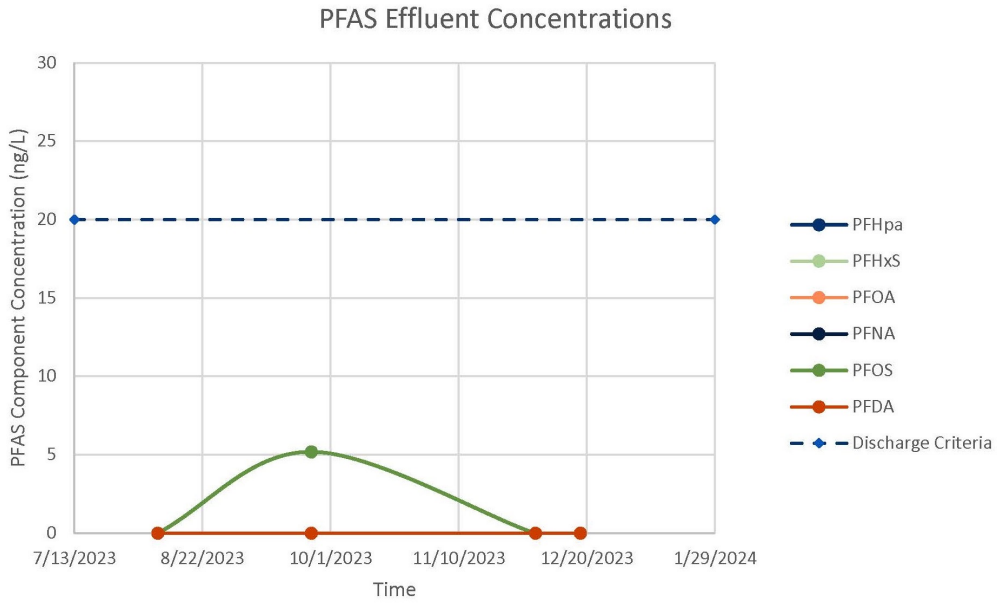

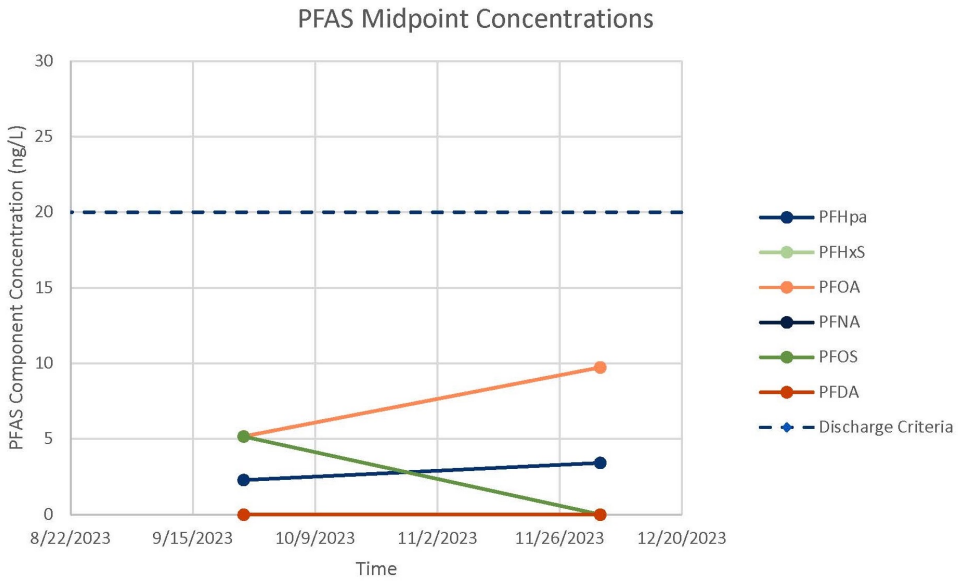

PFOS detections in Midpoint and Effluent on 9/25 are anomalous and likely not present in the stormwater.

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Performance

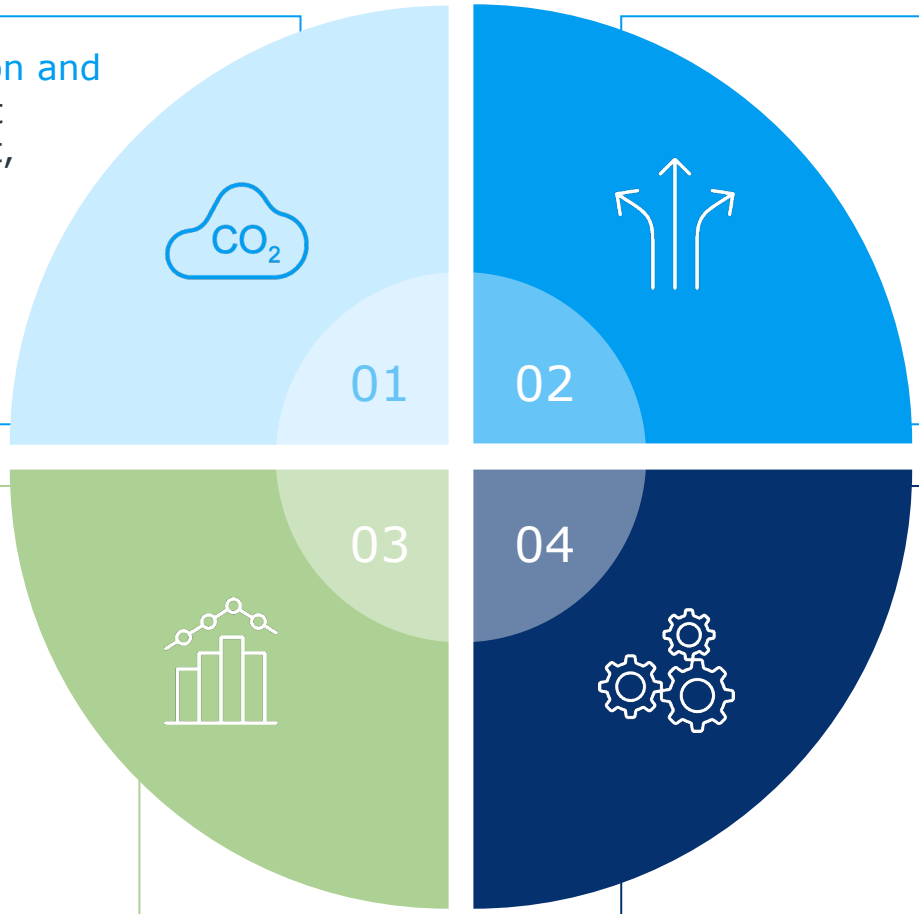
- Approximately 750,000 gallons treated in 5 months (average annual rainfall volume 1.4 million gallons)
- One overflow event recorded
- Discharge has met the effluent standard of 20 ng/L in all 4 sampling events

Challenges – Leaf and pine needle debris entering the frac tanks at a much higher volume than anticipated, resulting in overwhelming the pump strainers

- The facility installed mesh strainers at the pipe inlets to the frac tank
- BMPs to prevent/remove leaves and debris off the roof prior to rain events
- Exploring other technologies such as self-cleaning strainers

Key takeaways

Air emissions, subsequent deposition and stormwater runoff can be important sources of PFAS to the environment, including drinking water receptors



Proactive evaluation and addressing air and stormwater transport pathways may be important to control PFAS migration to drinking water supplies

Technology selection of GAC for removal of PFAS to meet drinking water standards was successful. SCTS has room for technology expansion if needed

SCTS PFAS influent concentrations were much lower in operation than modelled. The design assumption used data collected from first discharge, The amount of rainfall affects the influent concentration

THANK YOU

QUESTIONS???

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