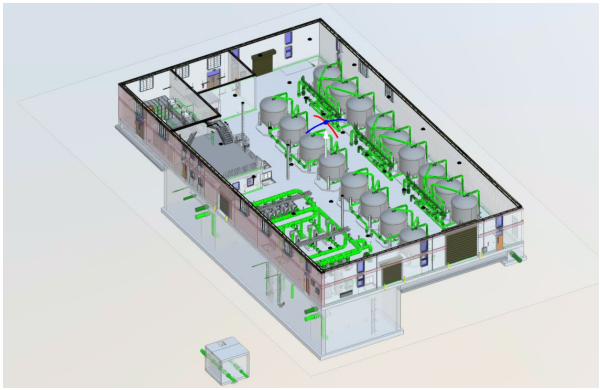
May 3, 2023

Planning and Design of an 18 MGD IX PFAS Treatment Plant



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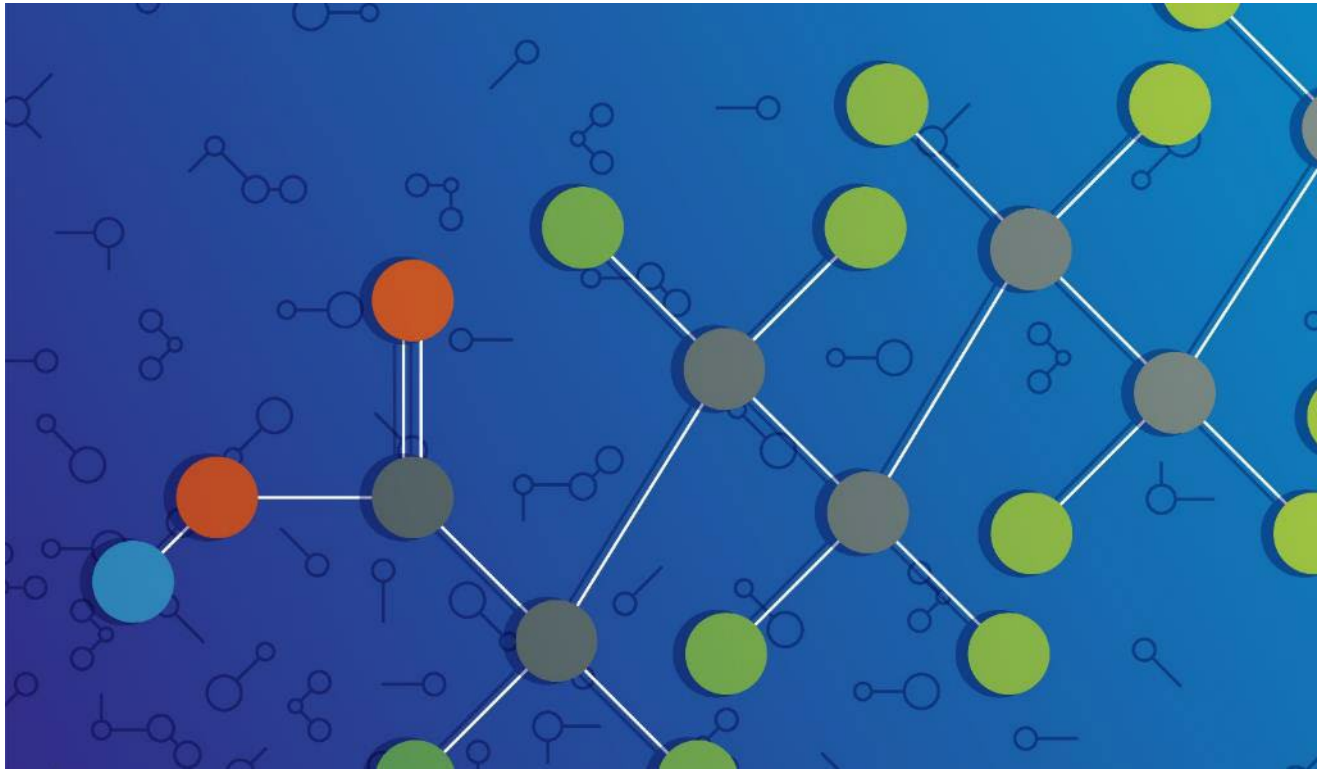
Agenda

- Background
- Treatment Alternatives Evaluations
- Pilot Testing Results
- Treatment Selection
- IX Design Highlights



South Adams County Water & Sanitation District

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67,000
Approximate population served

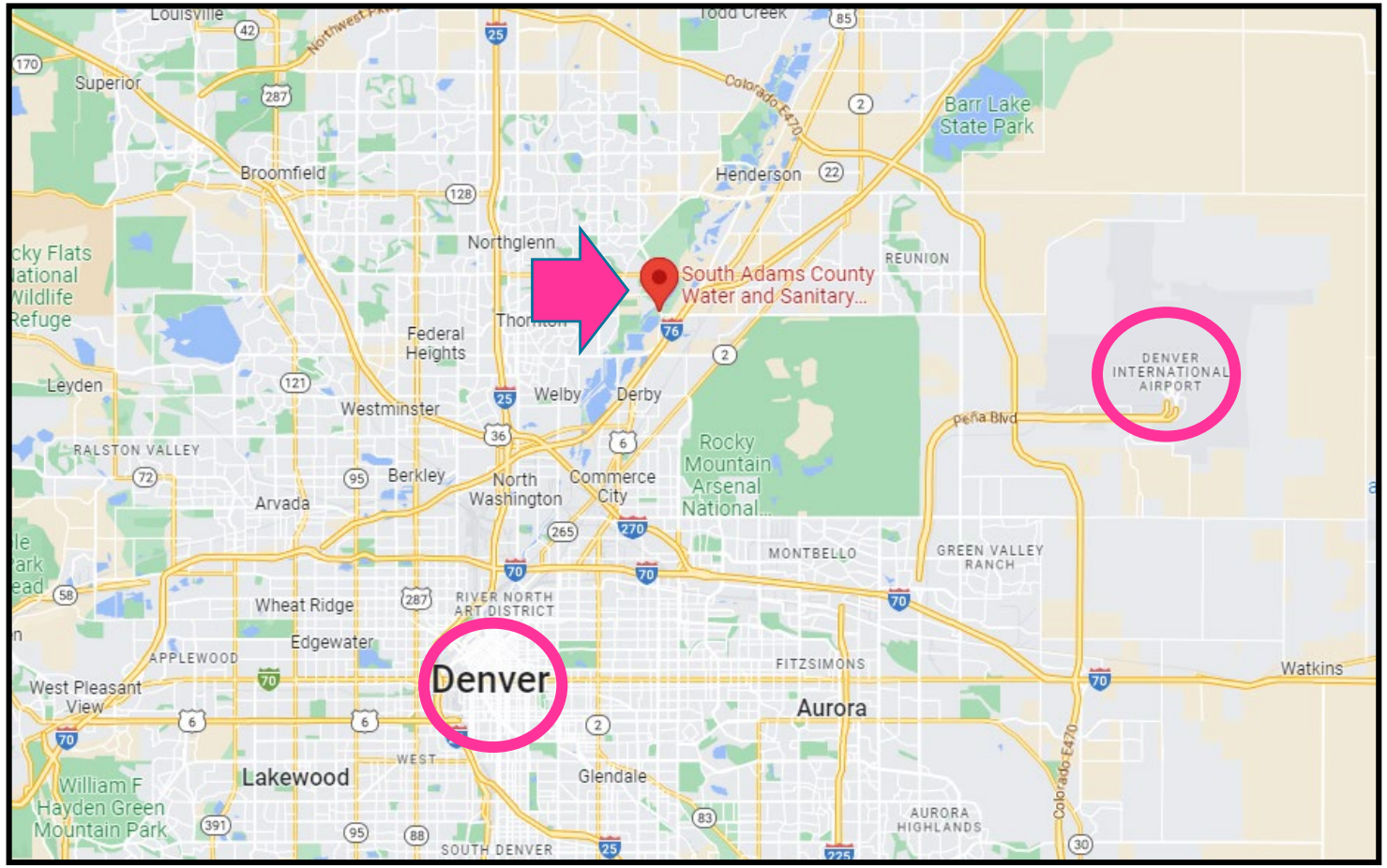
13.5 mgd
Current treatment capacity

18 mgd
Design water treatment capacity

~80%
Local potable water supply (groundwater) and **~20%** **Denver Water**

11 **alluvial wells** with a combined production capacity of 21 MGD provide local potable supplies

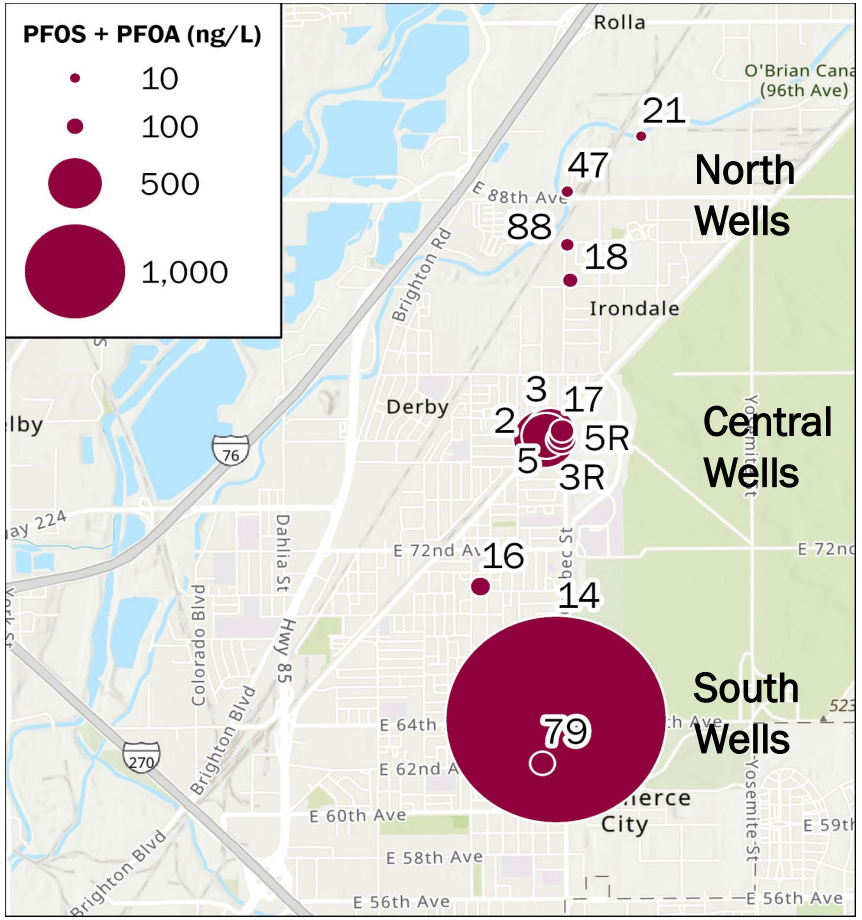
Location ~ 10 miles Northeast of Denver



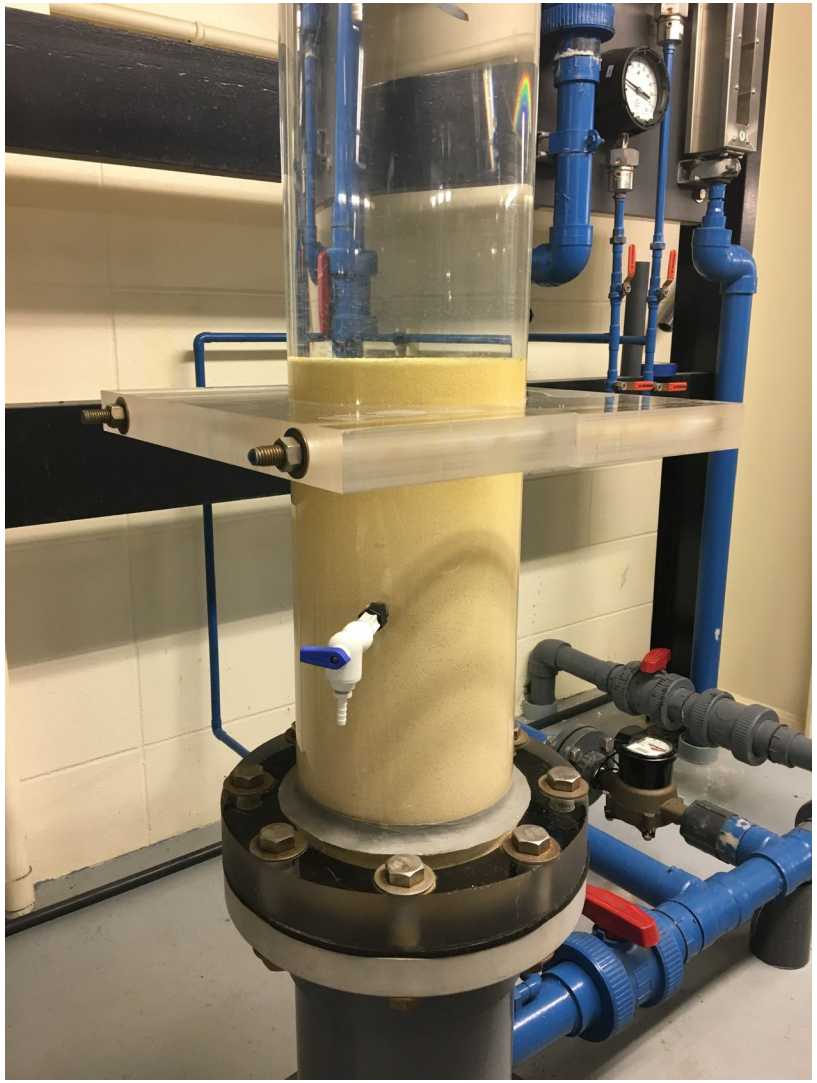
- Rocky Mountain Arsenal
- Firefighting training facility
- Stapleton airport

Water Quality

- Water served to customers meets all current Safe Drinking Water standards
- PFAS and 1,4-Dioxane found during CCL sampling
- Highest concentration in the south wellfield
- All water is treated at Klein Water Treatment Plant



What are the best options for South Adams for removing PFAS pollutants from drinking water?



Approach to studying PFAS at SACWSD

Full Scale

Evaluate performance of existing GAC system

Bench Scale

Test alternative carbon media

Pilot Scale

Pilot test IX resins on-site

Pilot Testing Results

Pilot testing of IX

- January 2019 – March 2020
- Side by side evaluation of 3 resins
- Pilot testing objectives
  - Assess performance of IX at treatment goals of 35 ng/l and non-detect (<2 ng/L)
  - Determine life cycle capital and O&M costs

- Resin
  - Purolite PFA694A
  - Purolite A592
  - Evoqua DOW PSR2+

IX Pilot Testing Results

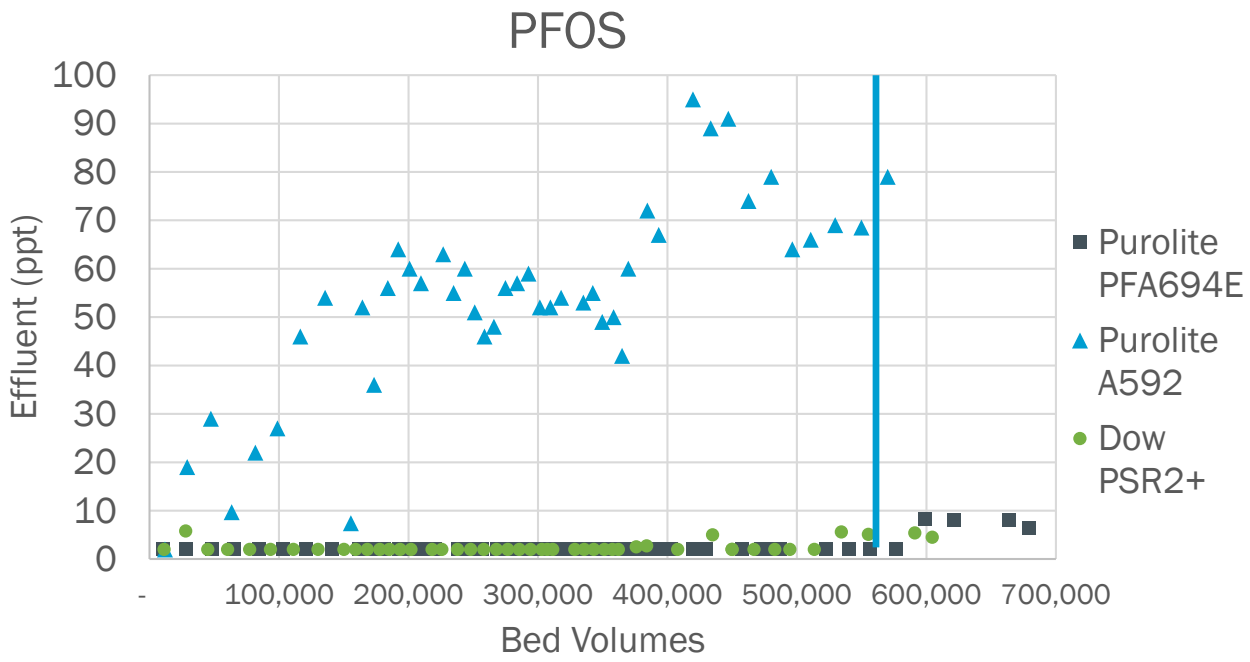


Figure 4-1. PFOS Effluent in IX Pilot

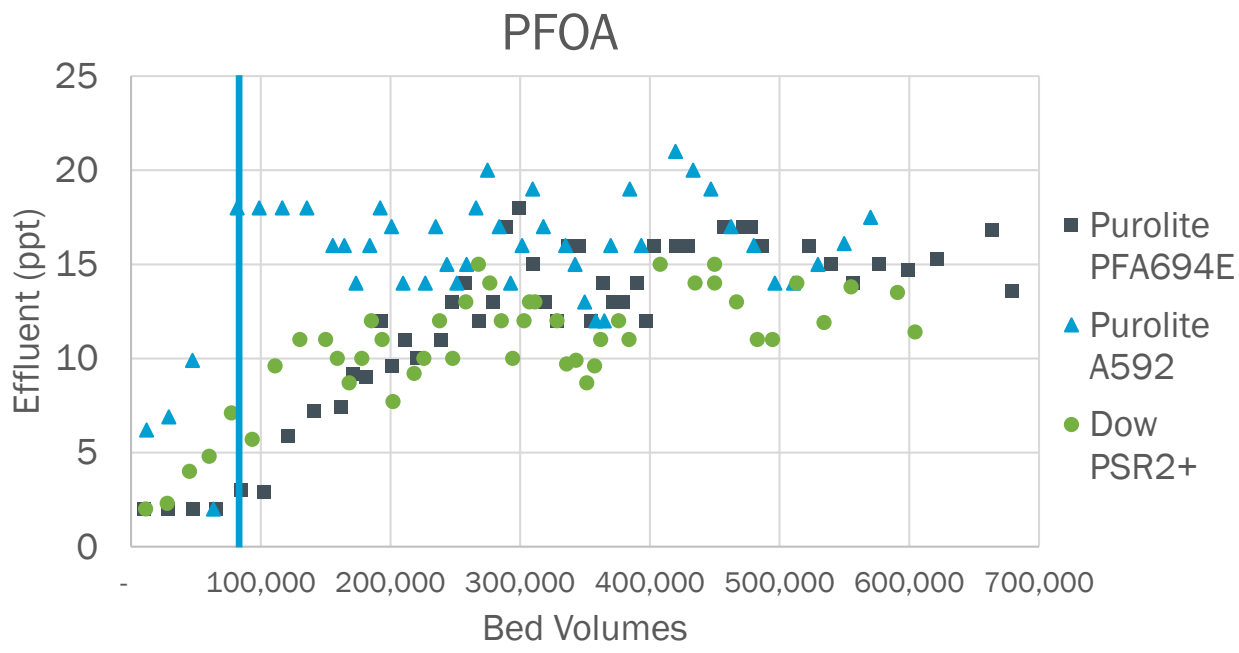


Figure 4-1. PFOA Effluent in IX Pilot

PFOS breakthrough 500,000+ BVs

PFOA breakthrough ~60,000 BVs

How was the proposed treatment selected?

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Alternatives considered

Add new ion exchange (IX) treatment

Enhance existing activated carbon (GAC) treatment

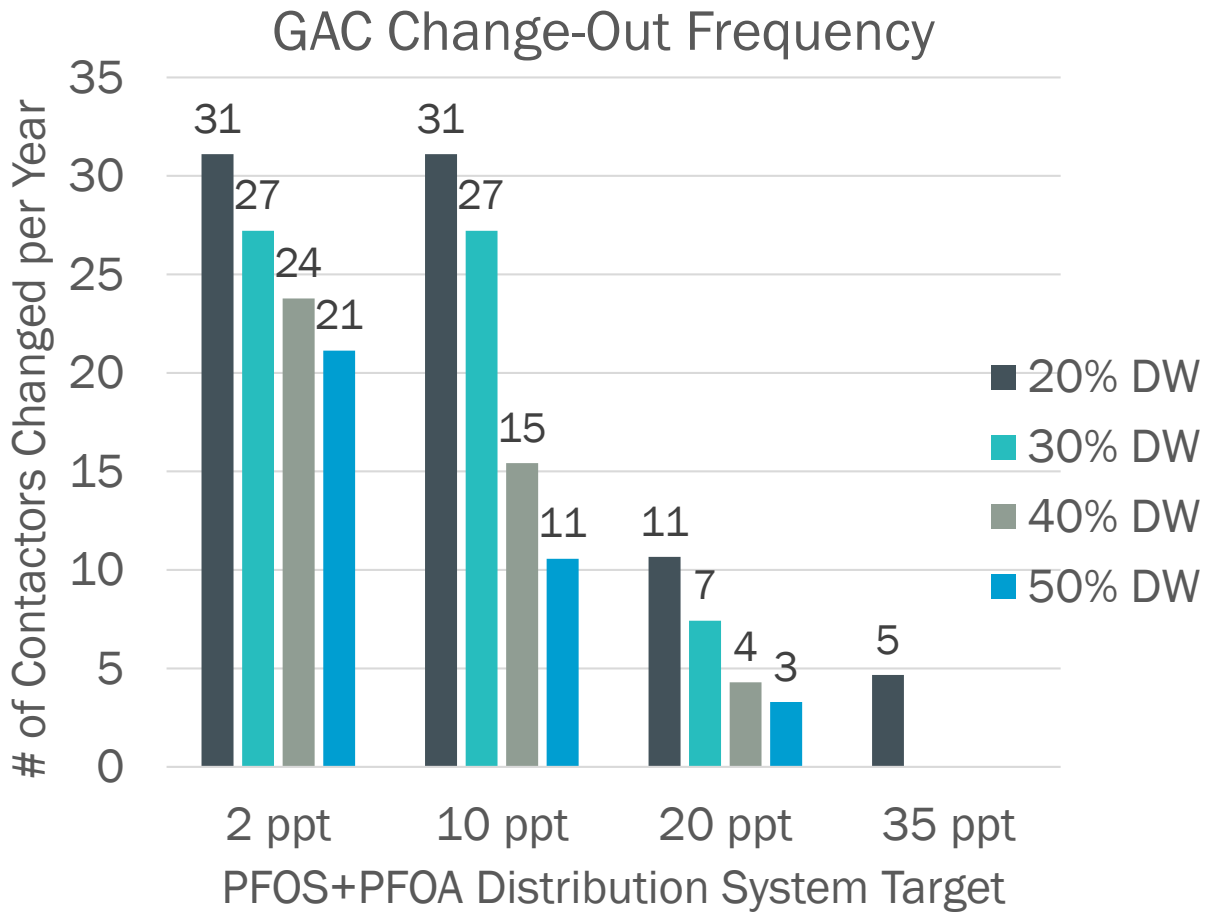
Different water sources

Alternatives comparison

	Ion Exchange Treatment	Activated Carbon Treatment	Different Water Sources
Pros	• Lower cost to maintain • Efficient PFAS removal	• Builds on existing technology • Operator familiarity	• Different water sources, such as purchasing from Denver Water, were explored. However, this was not found to be an affordable or sustainable alternative.
Cons	• Capital cost • New technology for staff • Operational costs	• Capital cost • Limited effectiveness for treating PFAS to low levels • Higher operating costs for media change out	

Cost Analyses Performed -

- GAC only
- GAC + Increased use of Denver Water
- GAC followed by IX polishing
- IX followed by GAC polishing
- IX for selected wells only



Proposed approach – IX followed by GAC – Online 2026

SHORT-TERM
1 - 4 years

- Increase Denver Water supplies
- Use water from wells where concentrations of PFAS is treatable with current technology
- Use existing activated carbon (GAC) to treat water as needed
- Regularly monitor levels in treated water

LONG-TERM

- Install ion exchange (IX) treatment facility capable of treating wells where PFAS has been identified and meet future regulations

IX Treatment Design Status

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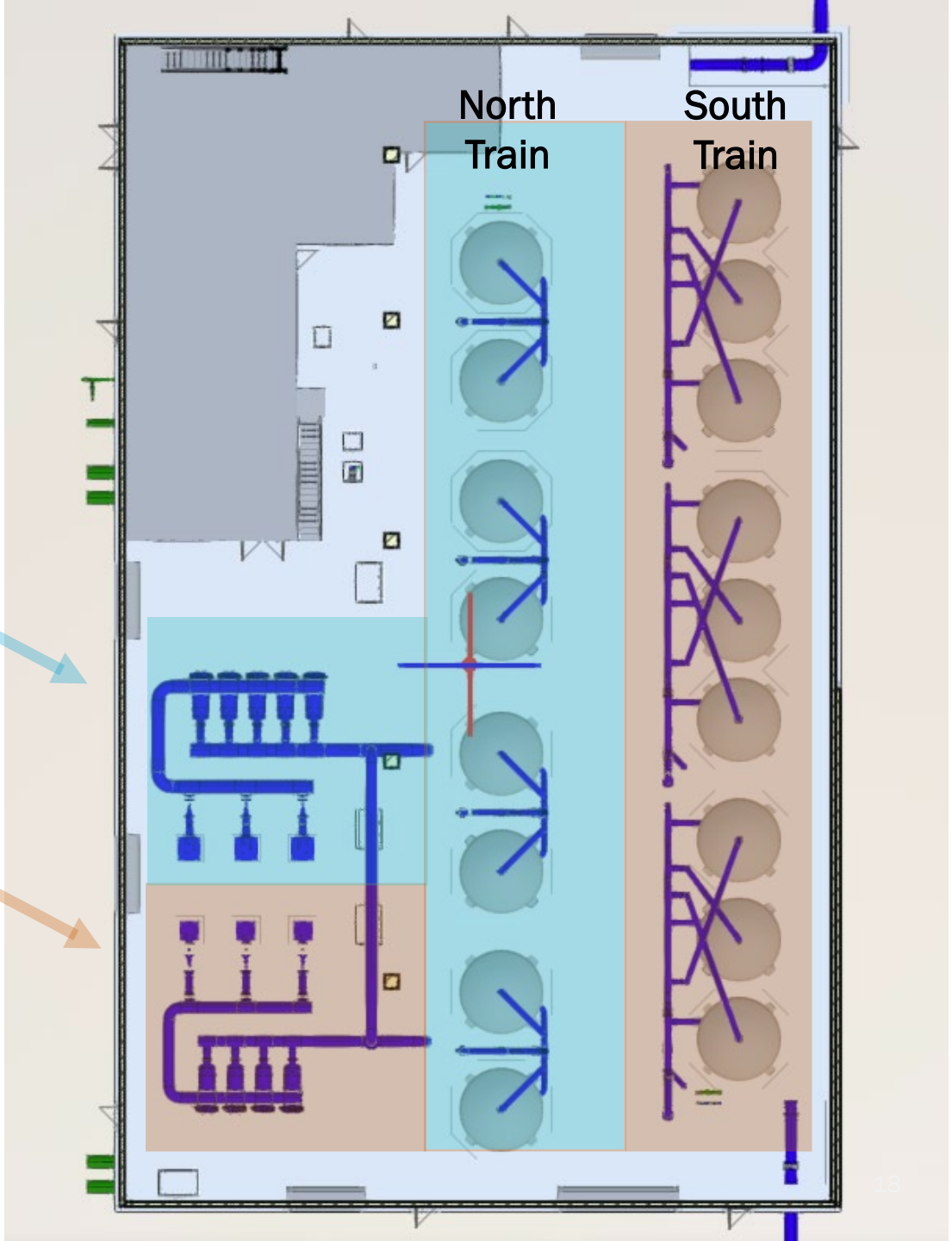
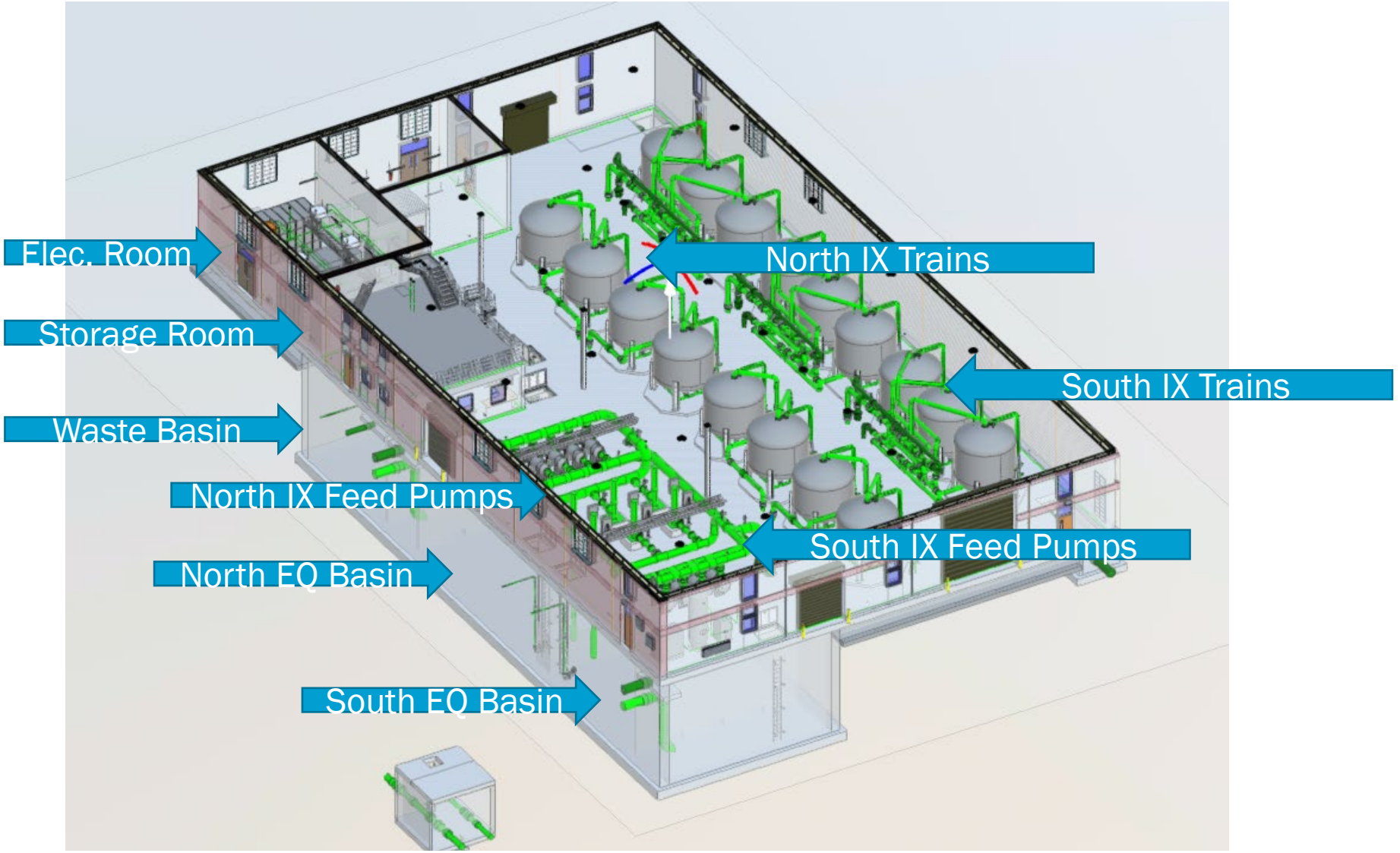
IX System Overview

- Separate treatment trains for different well fields
  - **North IX train (lower PFAS, 10 MGD)**
    - 330,000 gal EQ Basin
    - (3) 300 hp feed pumps (lead/lag/stdby)
    - (5) cartridge filters (1 stdby)
    - (4) **lead/lag** IX vessel pairs
  - **South IX train (higher PFAS, 8 MGD)**
    - 260,000 gal EQ basin
    - (3) 300 hp feed pumps (lead/lag/stdby)
    - (4) cartridge filters (1 stdby)
    - (3) **lead/lag/polish** IX vessel trains

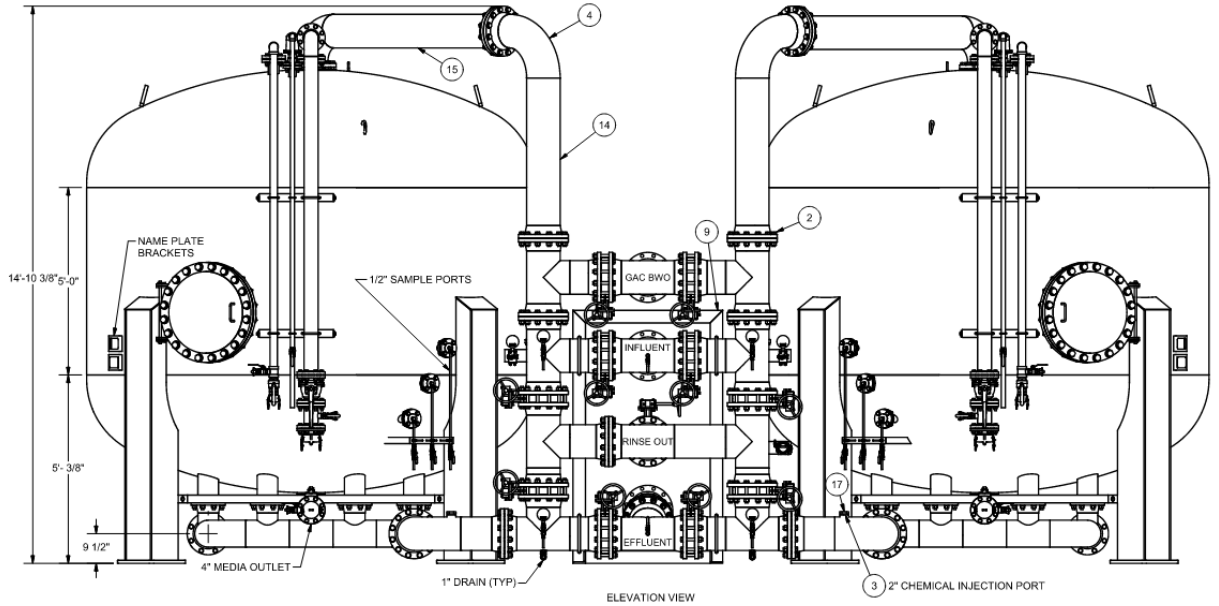


PFAS Treatment IX Site Layout



Key Considerations – IX Vessels

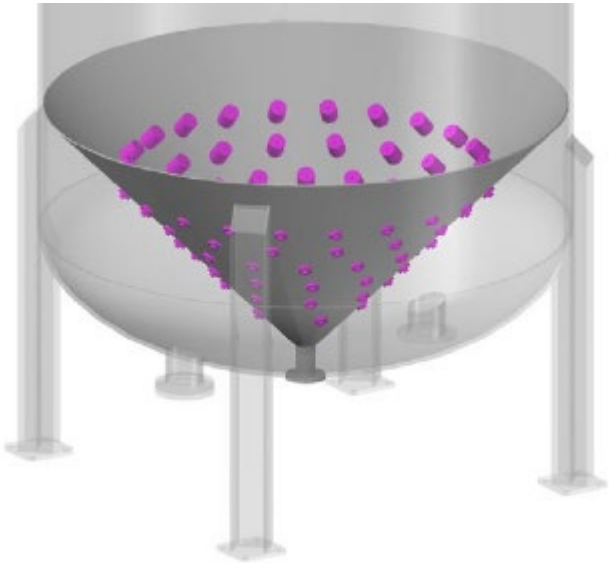
- Empty Bed Contact Time (EBCT) = 3 min
  - Treatment goal = ND
  - Utilize larger volume of resin
    - Slight adjustment to vessel sidewall (& overall) height
    - Can also operate with lower resin bed volume
  - Flexibility for other media, though not enough EBCT for GAC to treat equivalently

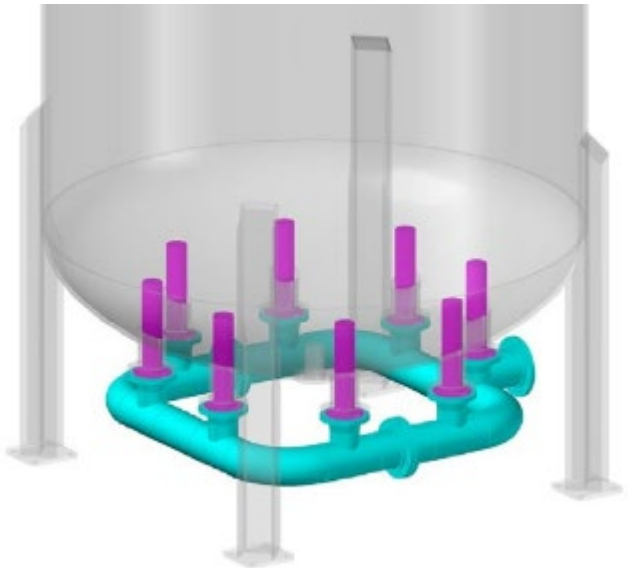


Source: AqueoUS Vets, 'Operations Manual – PF 12-520 LP IX.pdf', received 22 Dec, 2022.

Key Considerations – Underdrains

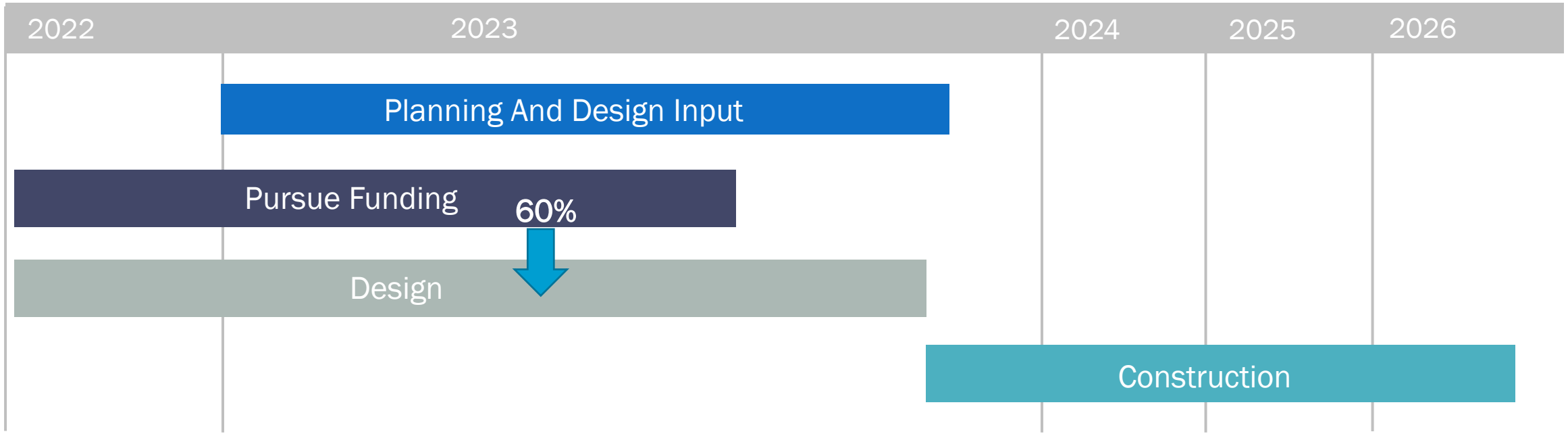
Internal cone	External header
• Improved hydraulics and flow distribution • Taller vessels • Additional welding and potential interior coating and corrosion challenges • Difficult maintenance access	• Shorter vessels • Continuous interior coating and fewer welds • No interior access needed to remove header • Spent media can be more difficult to completely remove





Source: Kuraray/Calgon, 'Underdrain Types.pdf', received 5 Jan, 2023.

Project schedule and next steps



Community Outreach in 2023

- Customer Newsletter Updates
- Community Meetings

Continuous Community Outreach Through the Project

Thank you.

Questions?

For additional questions:

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