

**Florida Keys National Marine Sanctuary  
(FKNMS) Water Quality Protection Program  
(WQPP) Steering Committee Meeting  
July 24, 2025**

Approach to Remedy  
PFAS in Biscayne Aquifer

**David Hackworth, PE., FKA**

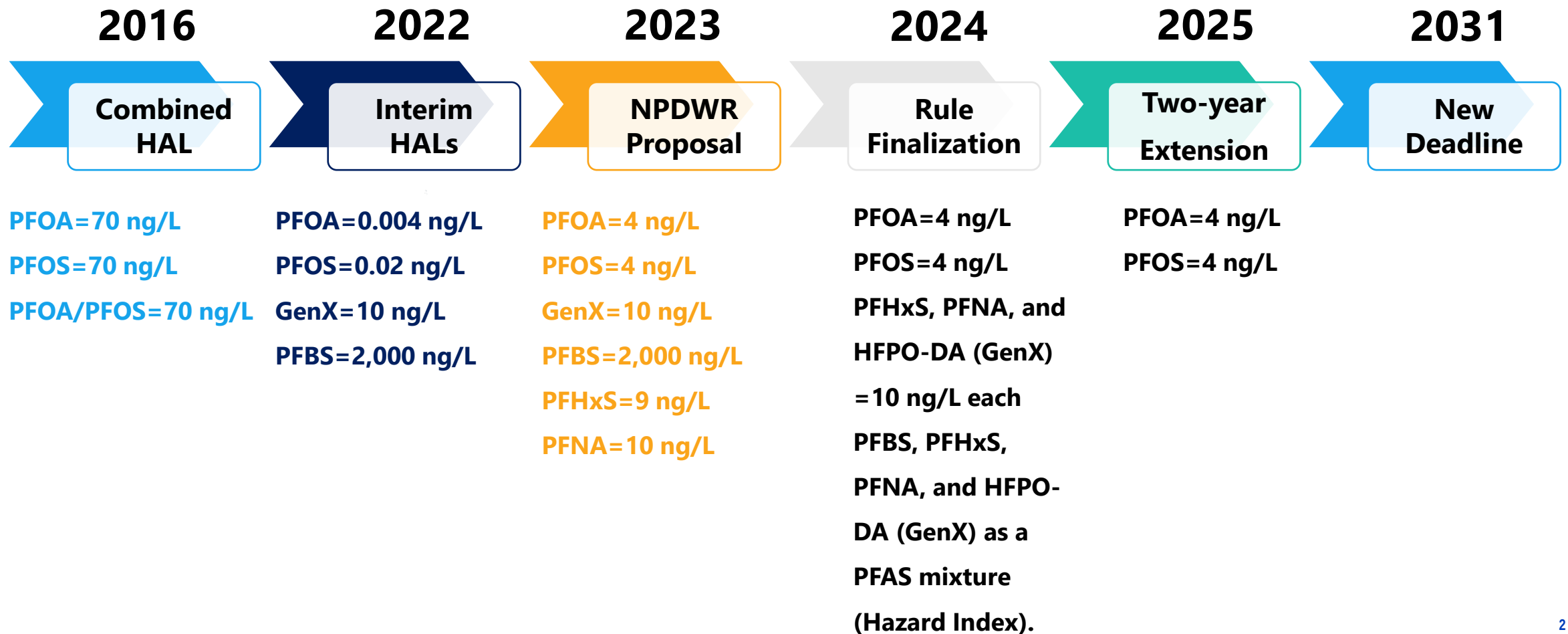


**Florida Keys  
Aqueduct Authority**



# Legal Challenges—Rapidly evolving regulatory framework

## *What and When?*



# FKAA's PFAS Journey



Compliance Deadline Extended to April 2031

# FKAA Water System

Current Demand: 22MGD

Florida City

23.8 MGD Lime Softening Plant

6 MGD Brackish Water Reverse Osmosis

Future Crawl Key (in Design)

4 MGD Seawater Reverse Osmosis

Stock Island

4 MGD Seawater Reverse Osmosis

Everglades  
National Park

Southern  
Glades Wildlife  
and  
Environmental  
Area

Crocodile Lake  
National  
Wildlife Refuge

Florida Keys  
Overseas  
Heritage Trail

Duck Key

Lloyd Key

Great White  
Heron National  
Wildlife Refuge

Cudjoe Key

Big Pine Key

# GAC Pilot Study

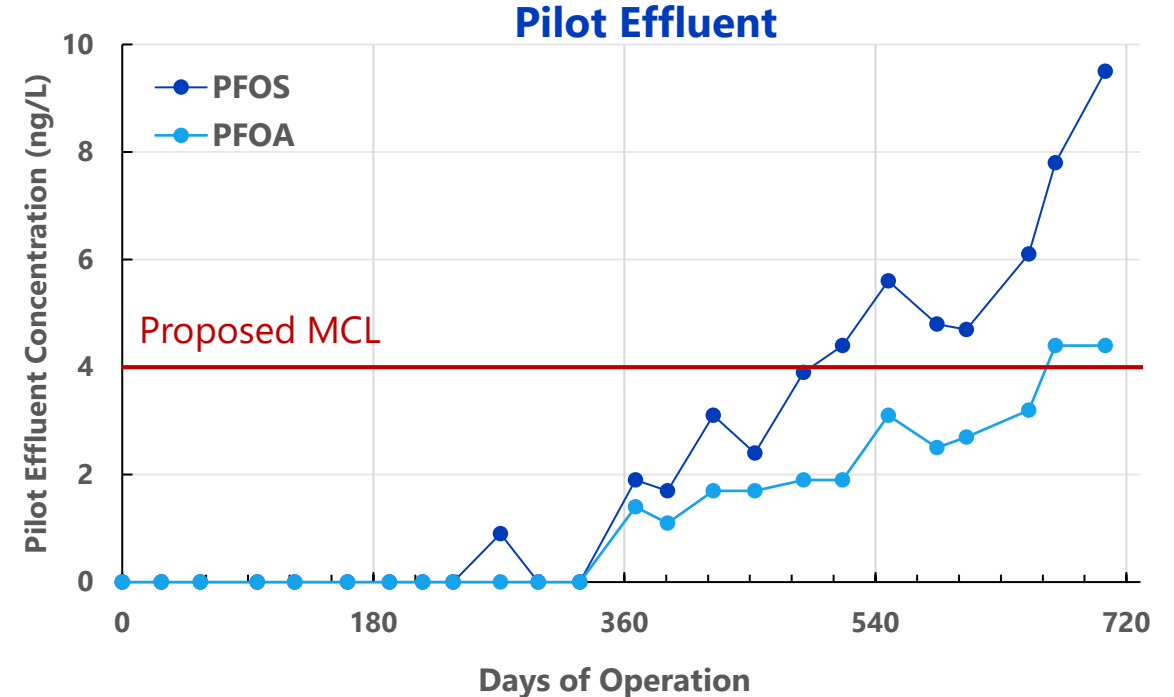
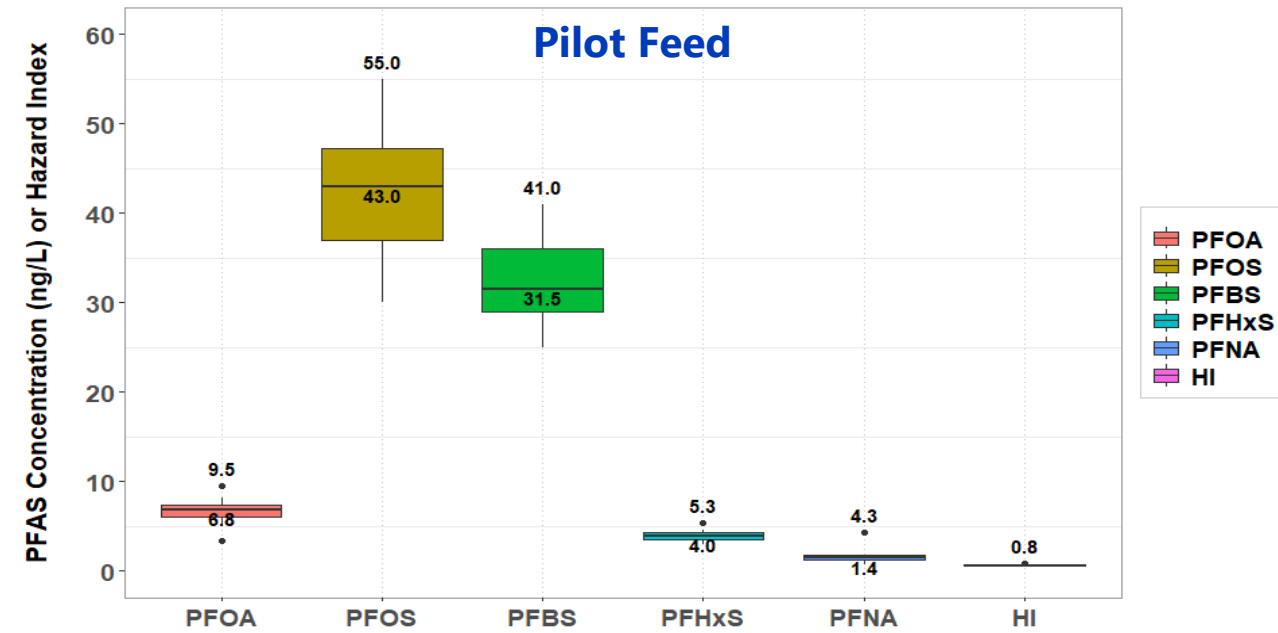


- GAC column design

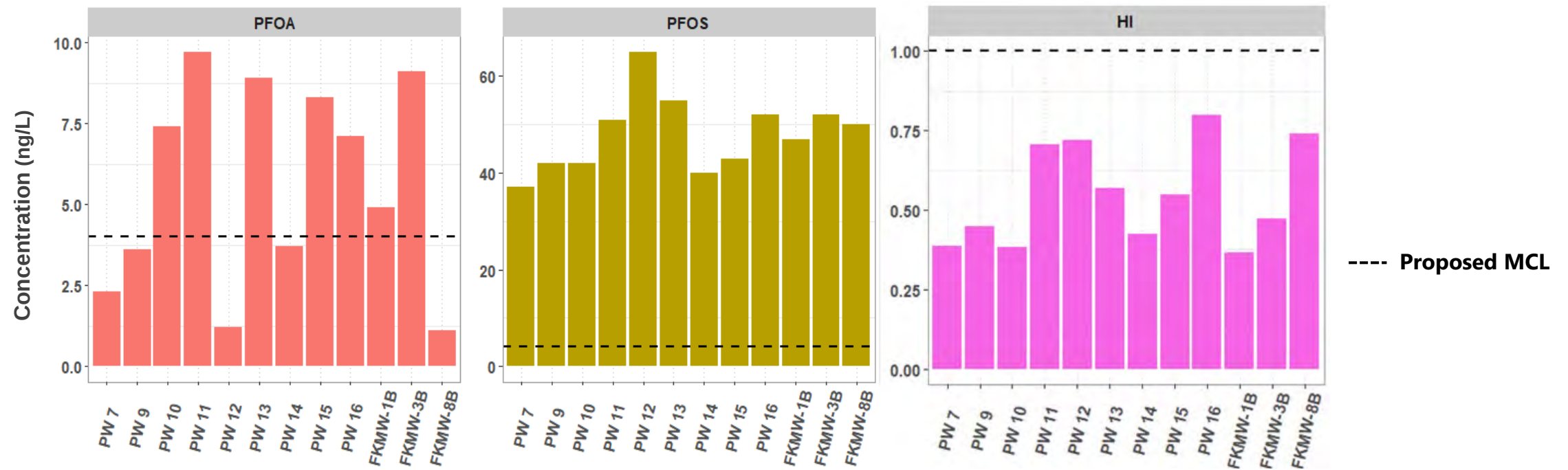
- » Diameter 12 inches
- » Length 3 feet
- » Volume 18 gallons
- » EBCT 20 min
- » Flow 0.88 gpm

- Operation

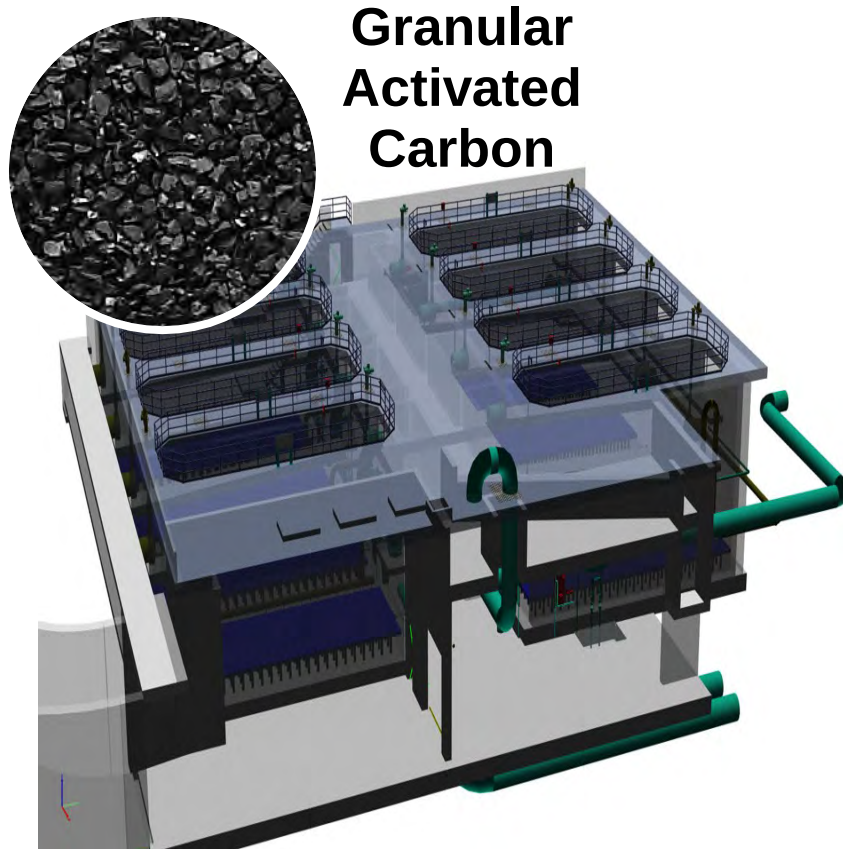
- » August 2019 – July 2021



# PFAS Occurrence in Biscayne Groundwater



# FKAA Evaluated three proven treatment technologies



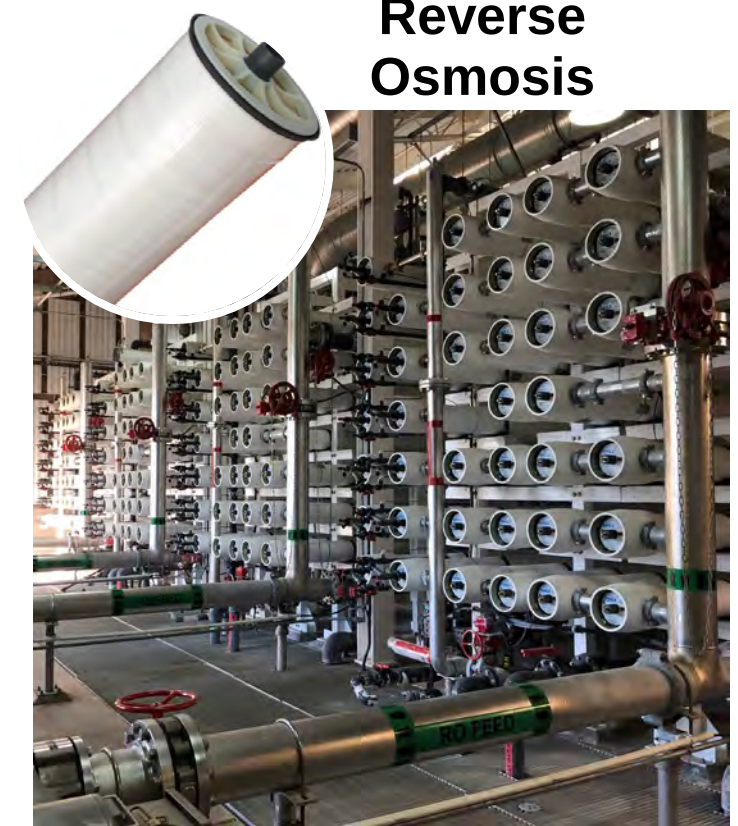
**Granular  
Activated  
Carbon**

- ❑ Larger footprint than IX
- ❑ GAC changeout and disposal



**Ion Exchange**

- ❑ Require good prefiltration
- ❑ High pumping energy
- ❑ Resin changeout and disposal

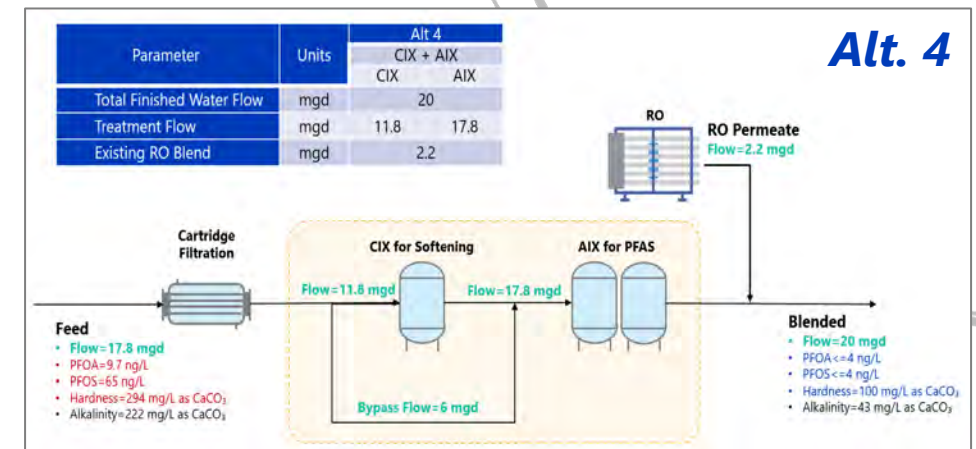
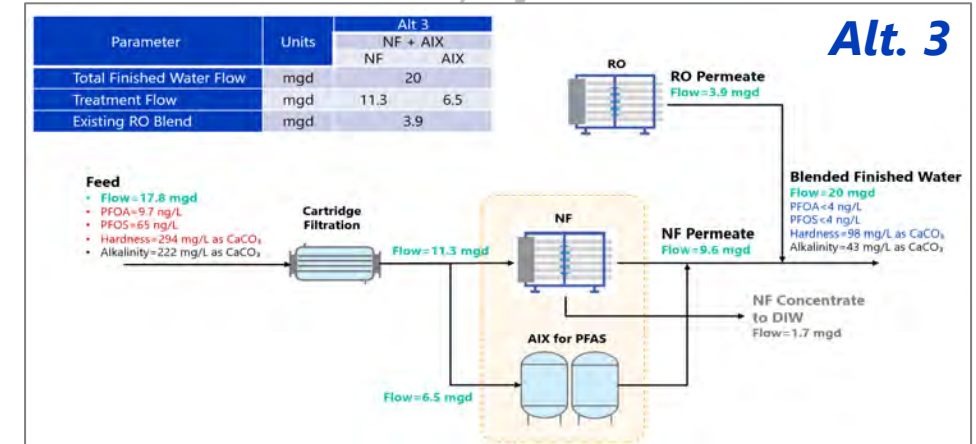
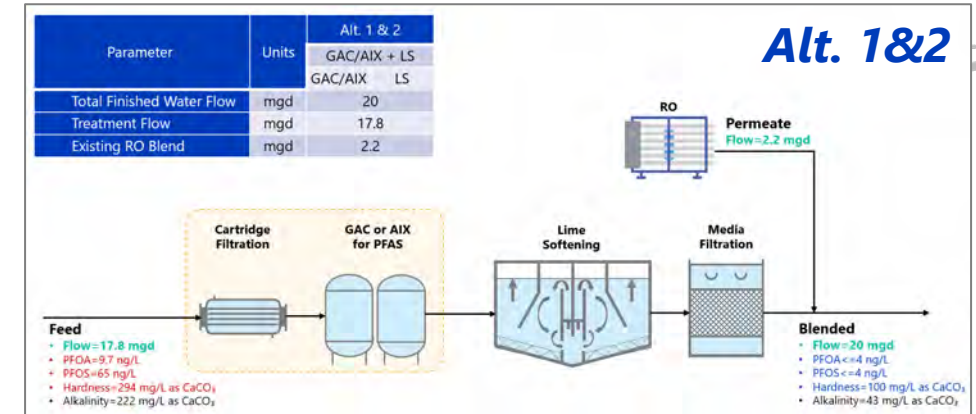


**Reverse  
Osmosis**

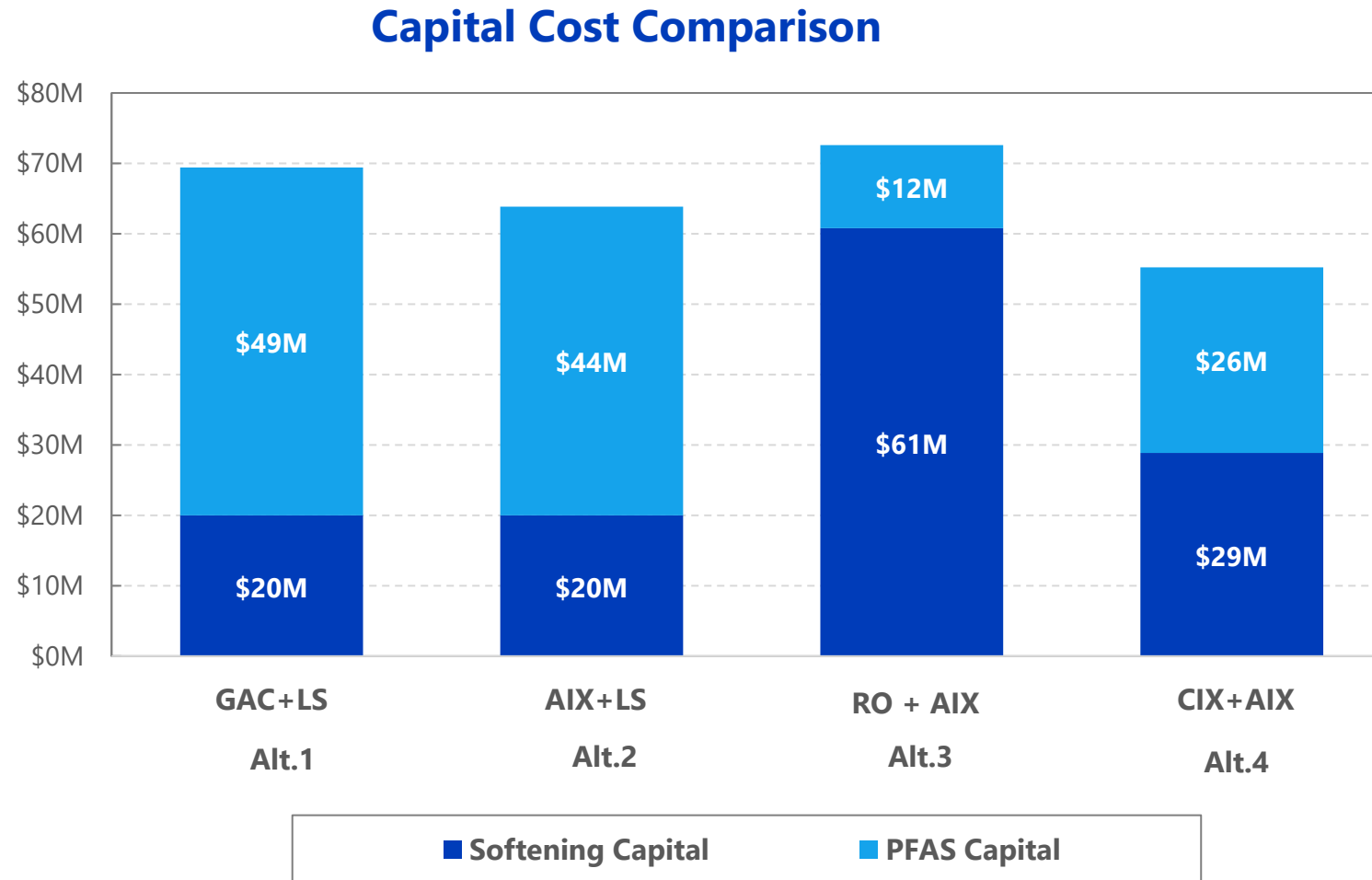
- ❑ Treats Emerging Contaminants and Softens
- ❑ Concentrate disposal (need a new DIW)
- ❑ Water loss

# Parallel comparison of treatment alternatives for hardness & PFAS

- Treatment goals
  - » Total finished water flow=20 mgd
  - » Finish water hardness=100 mg/L as CaCO<sub>3</sub>
  - » Meet proposed PFAS NPDWR MCLs
- Treatment alternatives
  - » Alt. 1—GAC (PFAS) + Rehab Existing LS System
  - » Alt. 2—AIX (PFAS) + Rehab Existing LS System
  - » Alt. 3—NF + Side-stream PFAS treatment by AIX
  - » Alt. 4—CIX (softening) + AIX (PFAS)



# Reverse Osmosis has the highest capital cost

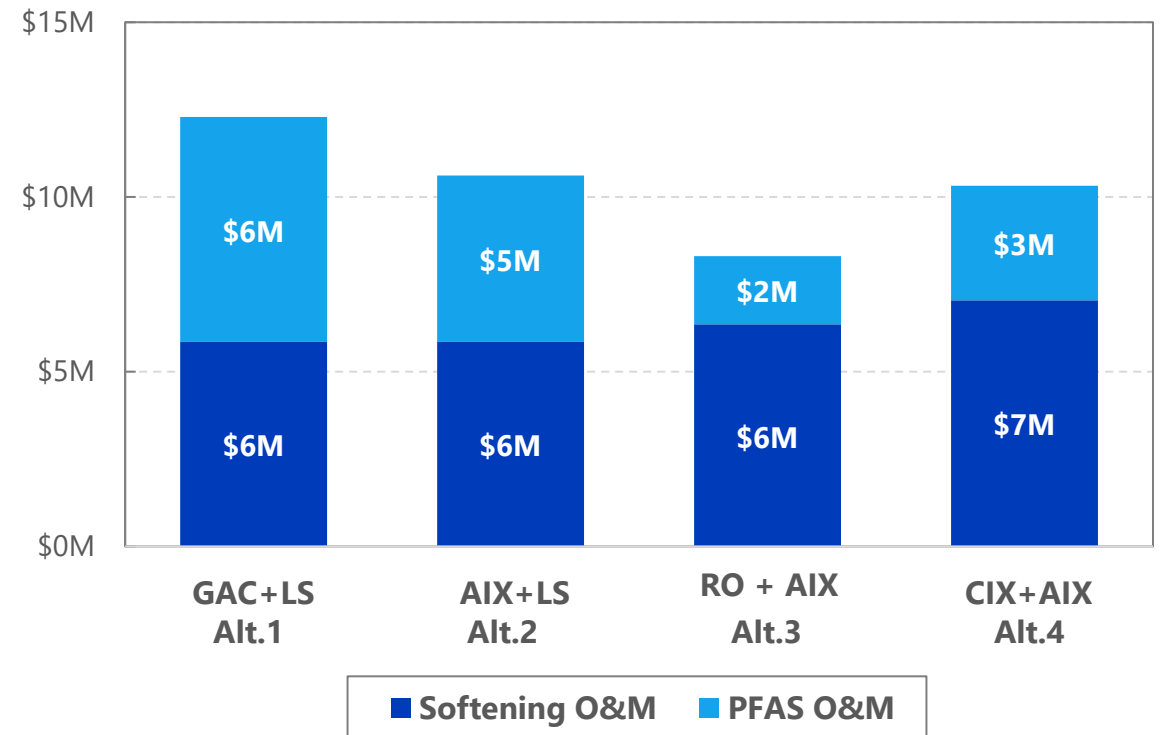


# More uncertainty is associated with PFAS-containing residual handling cost

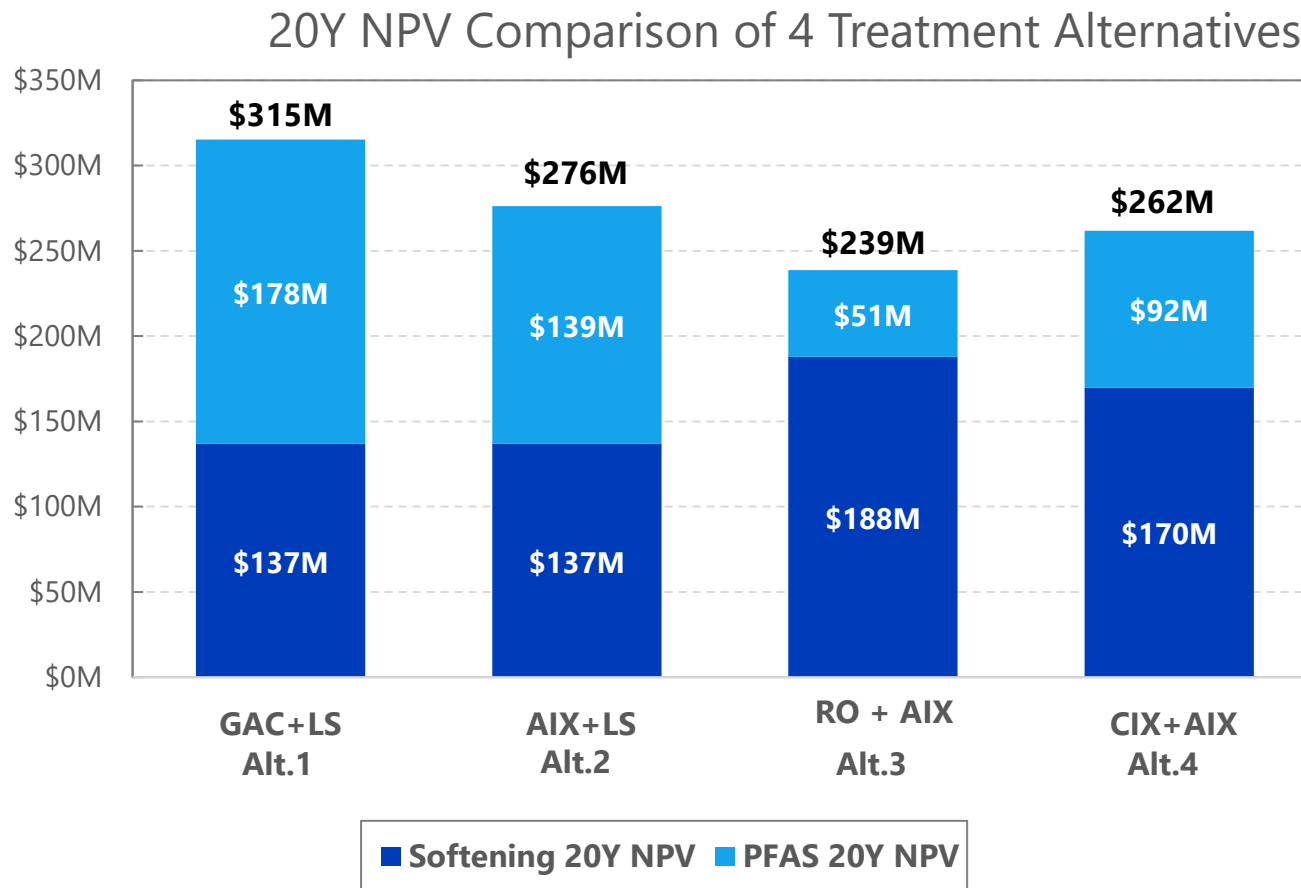
## Regulatory Uncertainties

- **CERCLA (Superfund):**  
**If deemed hazardous under CERCLA**  
Joint and retroactive liability increases disposal costs.
- **RCRA:**  
**If deemed hazardous under RCRA**  
Wastes generated from PFAS treatment facilities to be sent to RCRA Subtitle C permitted treatment, storage, and disposal facilities (TSDF).  
  
EPA proposed to designate 9 PFAS (PFOA, PFOS, PFBA, PFBS, PFHxA, PFHxS, PFNA, PFDA, GenX) as hazardous constituents to address PFAS contamination under the RCRA cleanup program (RCRA Corrective Action Program).

## Annual O&M Cost Comparison



Alternative 3 (RO + AIX) has the lowest net present value cost.



### Additional Benefits

- *Lowest Amount of Disposal Residue*
- *Reverse Osmosis removes emerging contaminants*
- *Reverse Osmosis is less labor intensive than lime softening*

- 11.3 mgd feed water flow
- 2-stage tight NF
- 85% projected recovery
- 9.6 mgd permeate

Existing Facility



New NF Facility Location

