### Background

#### Orange County Water District

#### OCWD was formed in 1933

- Management of the OC Groundwater Basin
- Protect rights to Santa Ana River water
- 19 municipal and special water districts
- 2.5 million residents



#### **Extent of PFAS Impact in OCWD Service Area**

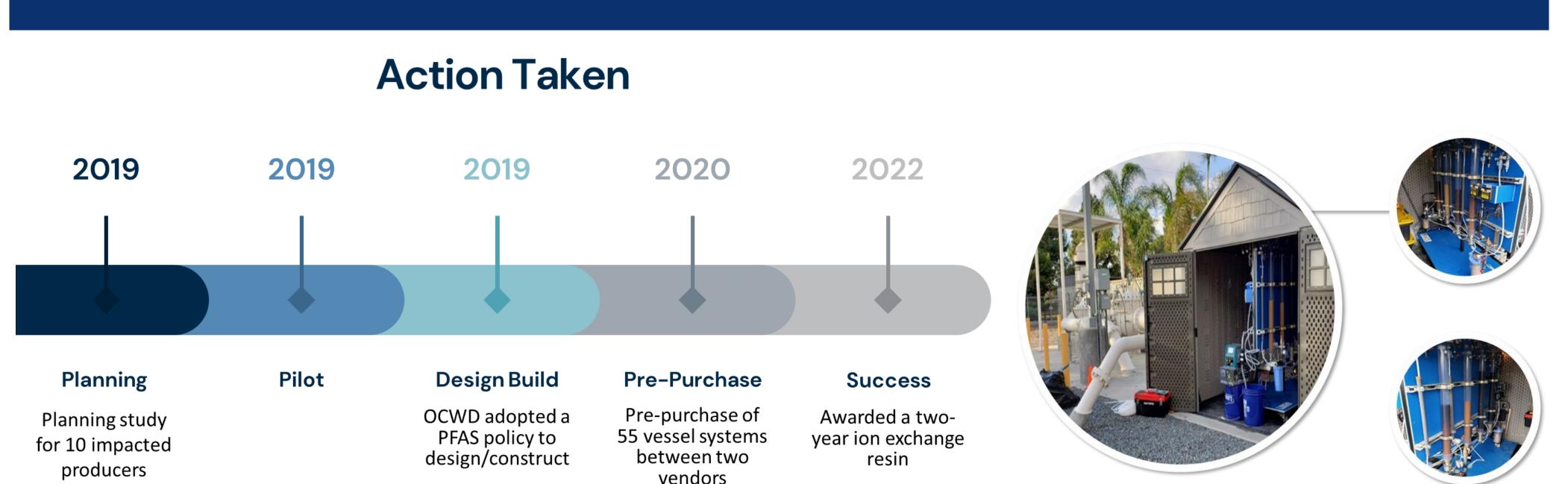
- 11 water retailers (i.e. groundwater "producers") and 58 wells in the service area impacted by 10 ng/L PFOA Response Level
- Up to ~1/3 of groundwater basin production (100,000 afy) unable to be served
- >\$50 million/year additional alternative water supply cost for treated imported surface water

#### Observations

- PFAS contamination is currently a national issue for both military and civilian drinking water sites
- Granular activated carbon (GAC) and ion exchange (IX) resin treatment have become the most economical solution in removing PFAS compounds from groundwater and considered best available technologies
- The Yorba Linda Water District (YLWD) was one of eleven (11) groundwater producers whose wells had low levels of perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS)

## AQUEO USVETS®

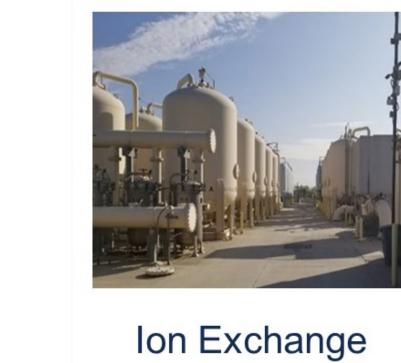
### Approach & Activities



#### PFAS Technology Evaluation

# Granulated Activated Carbon (GAC)





## PFAS Treatment Pilot Test

- Purolite® Purofine
- DuPont Amberlite PSR2+®
- ECT2 Sorbix™ LC4
- 4 GAC Medias including subbituminous and bituminous carbon

## PFAS Treatment Facilities for 11 Water Retailers

- 36 PFAS WTPs
- 58 Wells
- 96 Lead-Lag Pairs of Vessels
- \$275M Capital Cost

#### Yorba Linda Water District— History

- Established in 1909
- 25,000 service accounts
- 9 groundwater wells
- 14 reservoirs
- 12 booster pump stations
- 4 imported water connections
- 25 MGD PFAS Water Treatment Plant

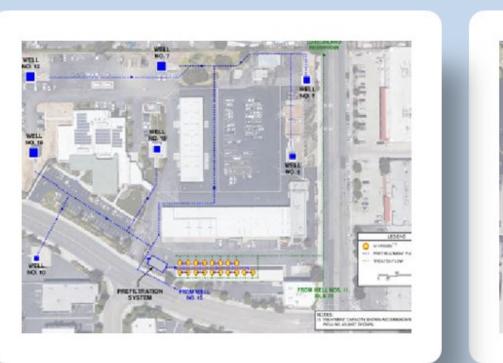


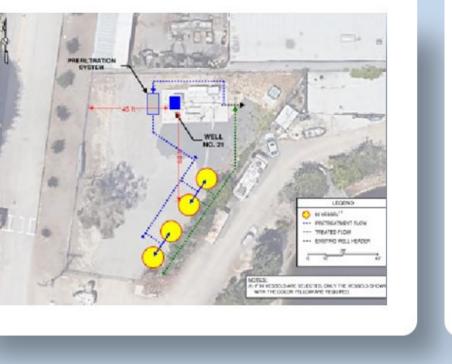


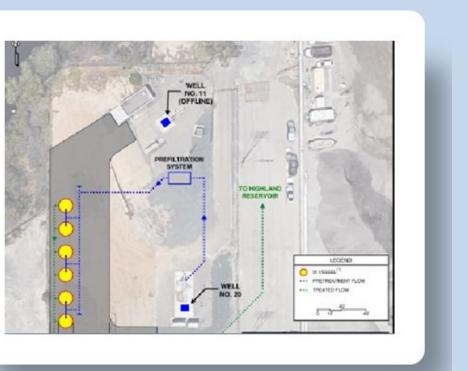
Yorba Linda Water District PFAS Treatment

#### Results

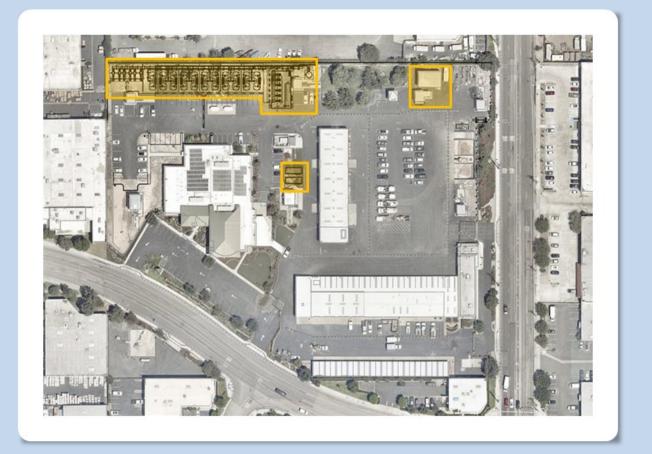
#### Option 1: 3 PFAS Water Treatment Plants







Option 2: Centralized Plant at YLWD HQ's



#### 3D YLWD PFAS Treatment Plant Walk-Through





#### YLWD PFAS Water Treatment Plant



#### PFAS WTP Pre-Filters and Ion Exchange Vessels



#### Booster Pump Station, Backup Generators & Chlorination Facilities



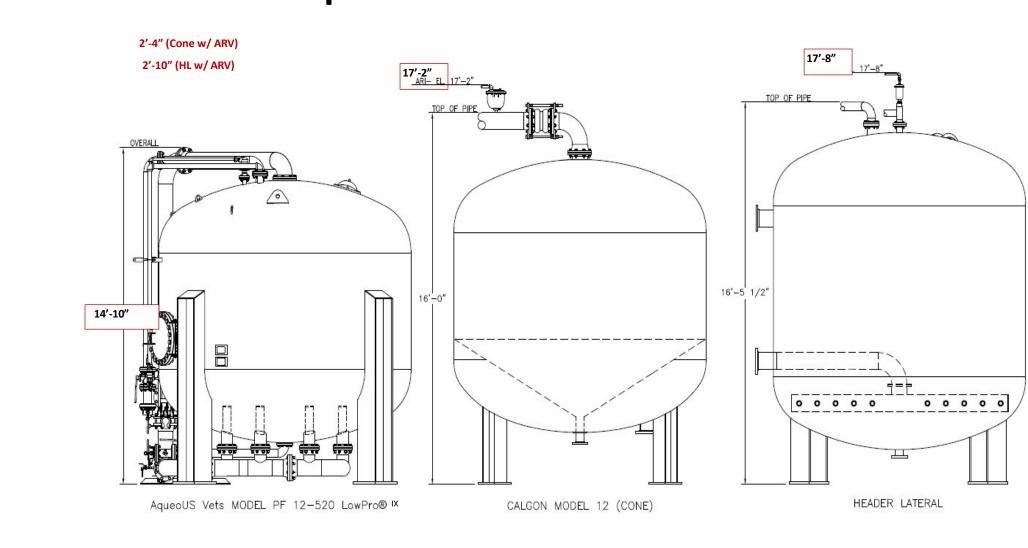
#### Lessons Learned

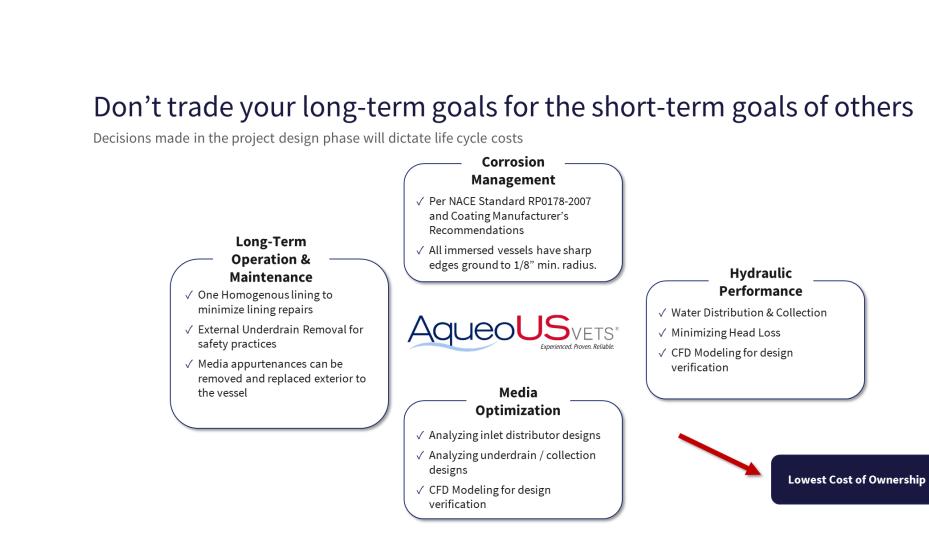
#### Choosing a Quality System

#### Understanding and selecting mechanical designs

Evaluating the design can provide cost savings

- Reduced building and construction costs
- H<sub>2</sub>O distribution and collection system
- Reduced head loss resulting in decreased energy consumption
- Optimized media utilization





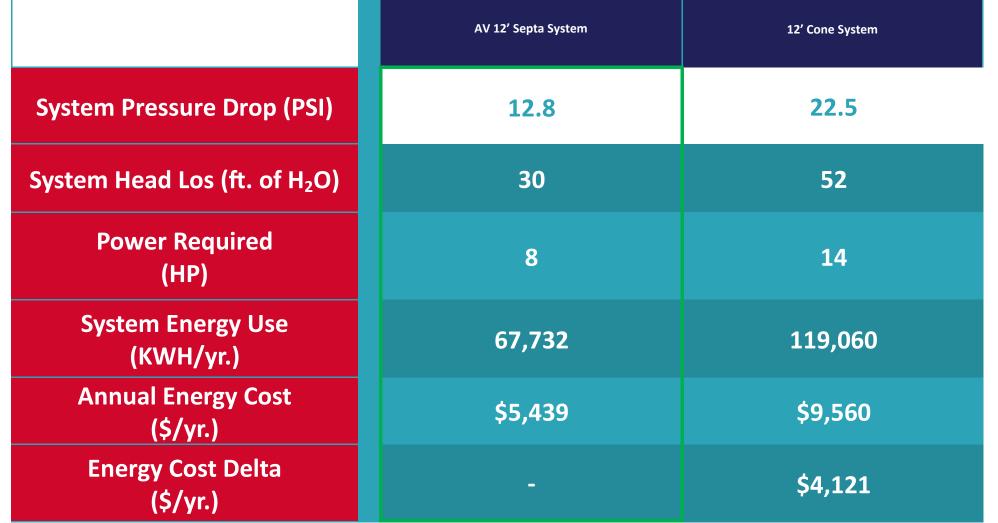
#### Computation Fluid Dynamic (CFD) Modeling

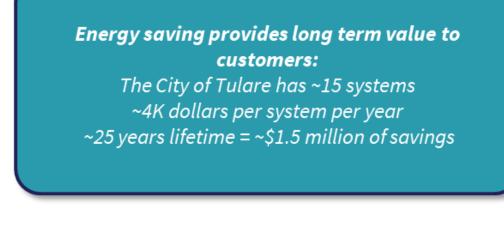
Illustrates distribution and collection of flow

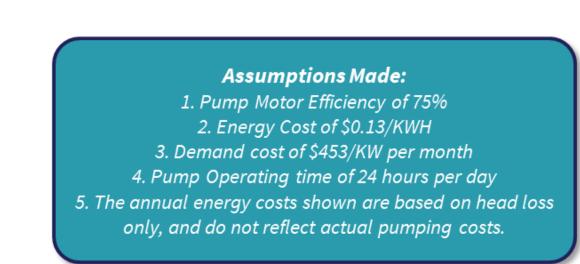
#### **Total Cost of Ownership**

Patented AV® design offers clients the lowest cost of ownership

Illustrative energy savings from typical AV design







#### **Construction Challenges**

COVID

Labor shortage

Supply chain issues

Operations impact

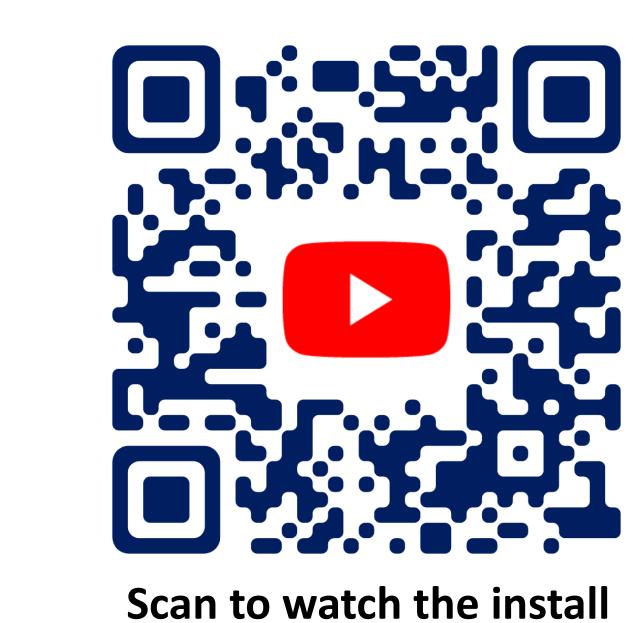
#### **Increased Construction Costs**

Lead-time for utility agency review

Schedules – delays cost \$

Vendors, contractors, consultants





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