

PFAS Mitigation Strategy and Lessons Learned by a Regional Water Provider

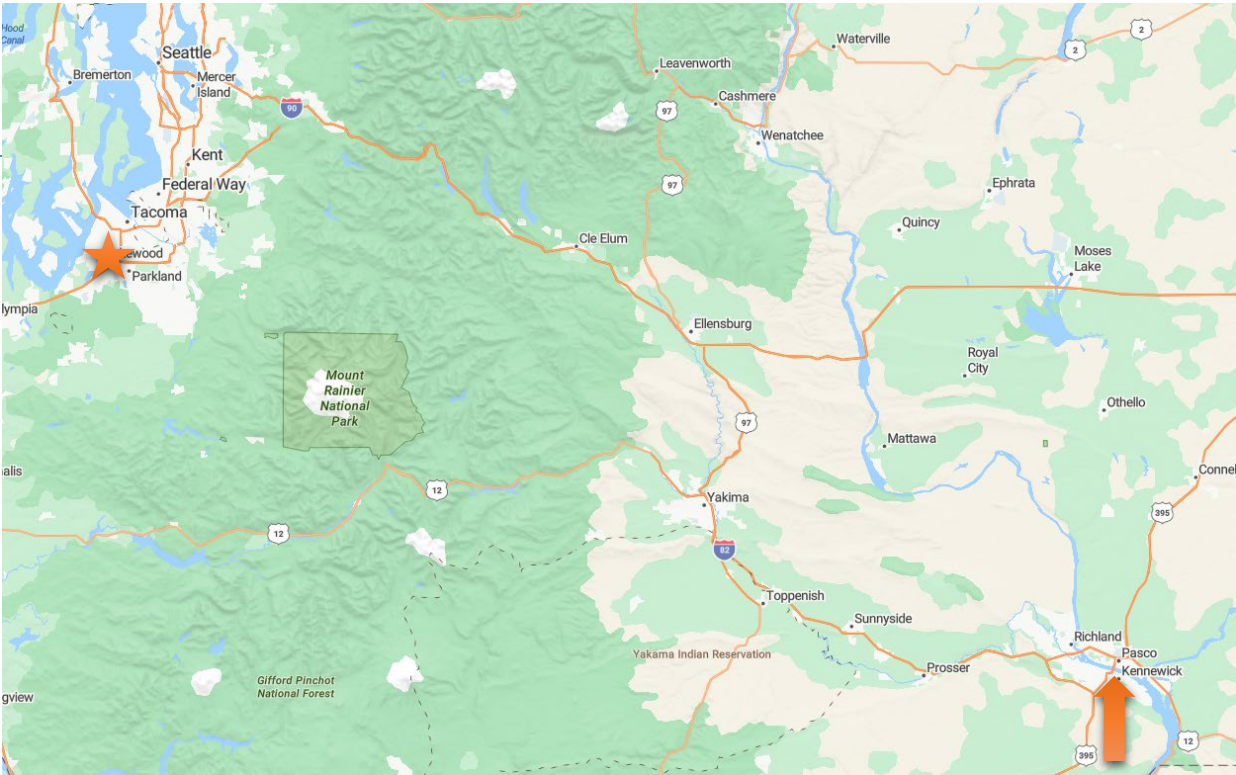


PNWS-AWWA
May 3, 2023

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Engineering Manger
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Lakewood Water District

- Formed in 1943
- Governed by elected board of three commissioners
- 60,000 customers
- 5 wholesale customers
- Total ~115,000 people served



35 Staff Members
6 Depts.



13 Tanks
28.3 MG storage



29 Active Wells
Capacity to pump
37 mgd



275 Miles of
Transmission Main



2,087
Hydrants



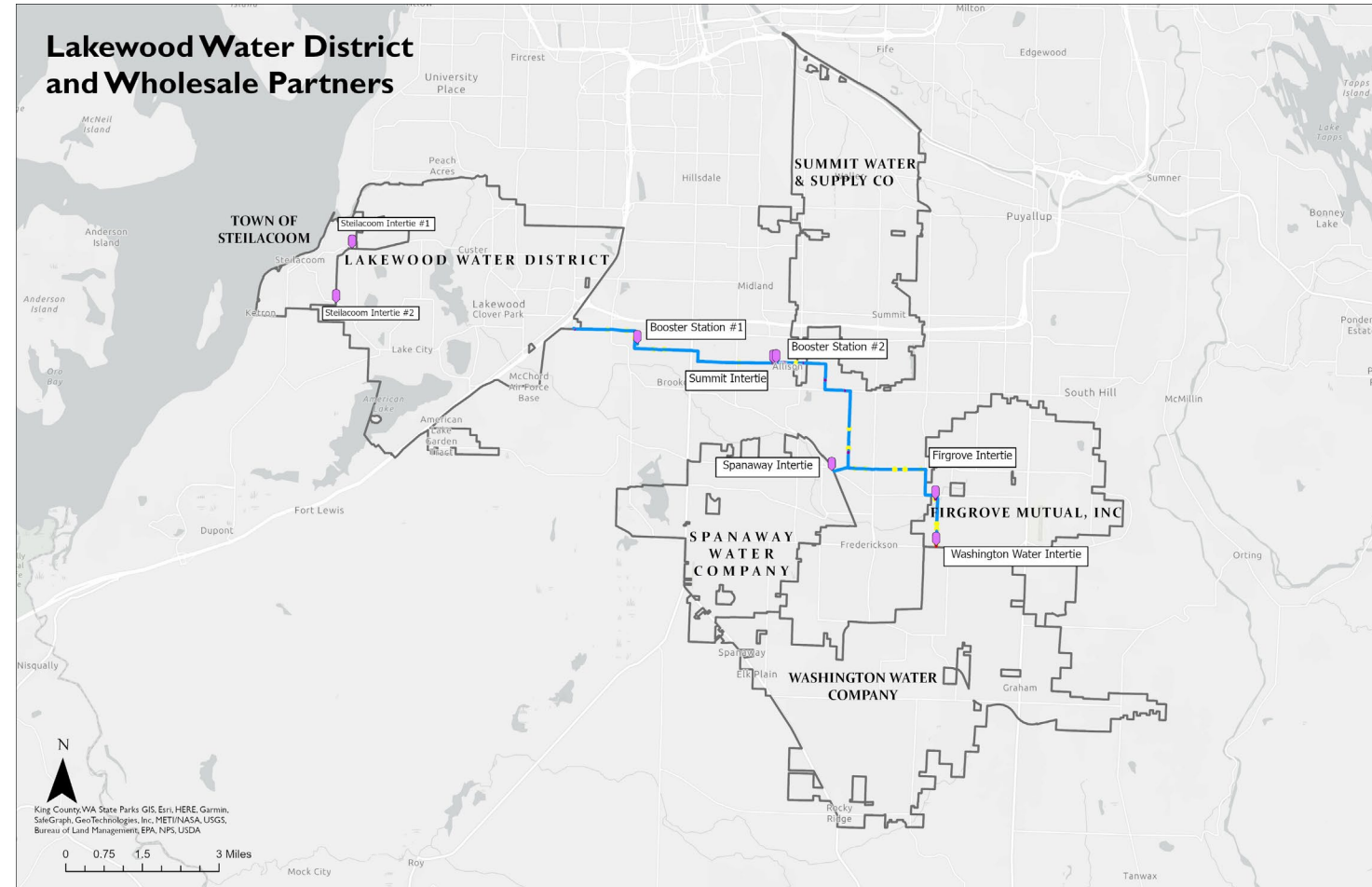
17,193
Svc. Connections



Lakewood Water District – Regional System

Wholesale Partners

- Town of Steilacoom
- Summit Water and Supply Company
- Firgrove Mutual Water Company
- Spanaway Water Company
- Washington Water Company

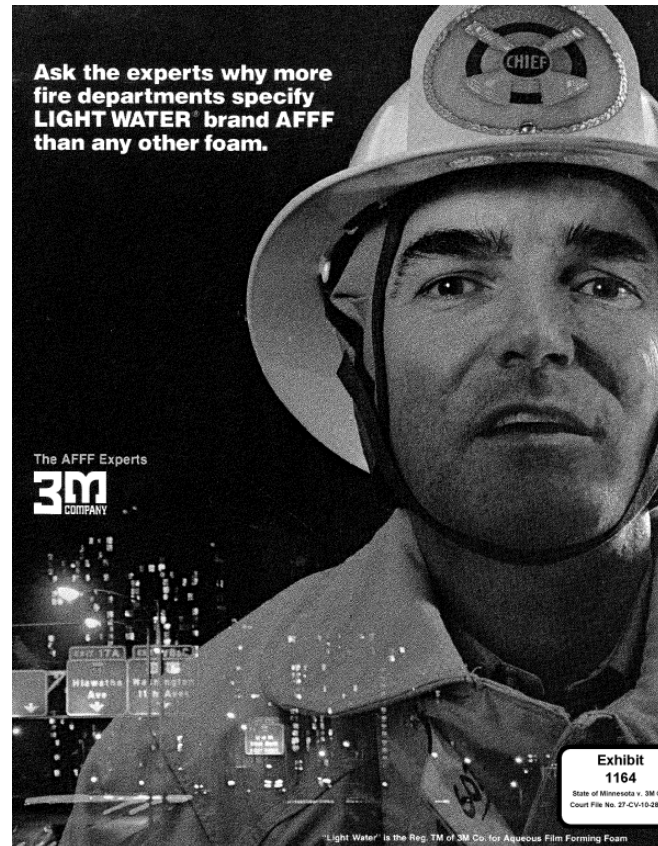


What are PFAS



Source: LIFE Magazine, Apr 14, 1961

3M – Minnesota Mines & Manufacturing



Source: 3M Brochure 4/1/1978

AFFF – Aqueous Film Forming Foam



Source: Minnesota's PFAS Blueprint

Our Journey at a Glance

2016 PFAS was discovered at Joint Base Lewis-McChord

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Filed Lawsuit Against the Federal Government.

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Turned off any sources at or above the SAL - U-1, O-2 & O-3, and I-3 wells.

Received \$5.56M for Scotts wellsite GAC

WA State SAL Level went in effect 1/1/22

Scotts GAC system G3 & G4 Wells installed

Applied for grants to replace U-1, O-2 & O-3, and I-3 wells.

2016
2017

2017
2019

2020

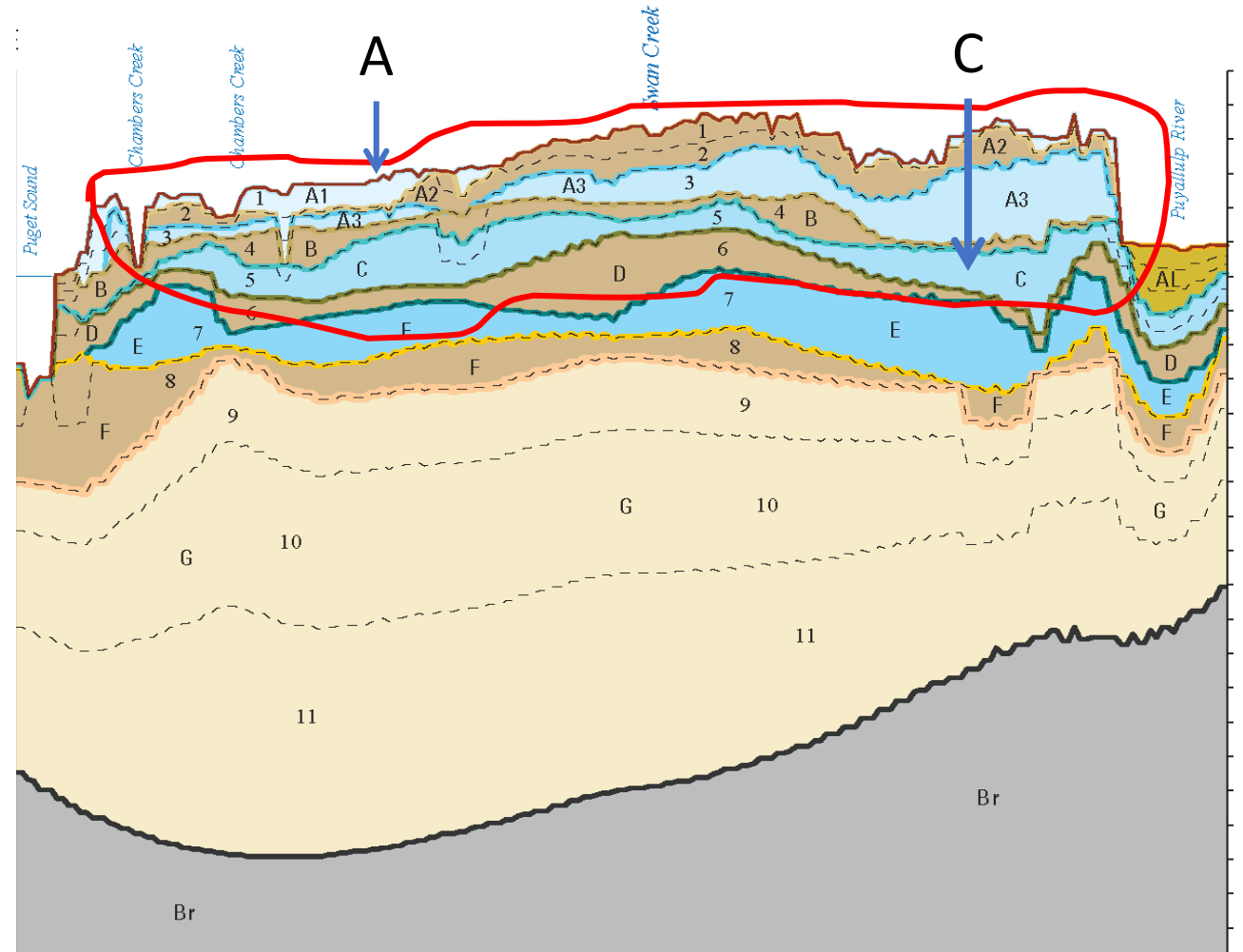
2021

2022

2023

Lakewood Water District's Water Sources

- Lakewood has 29 wells drawing from four aquifers
- Only the shallowest aquifer is known to contain PFAS— affecting 13 wells
- We use the A & C aquifers

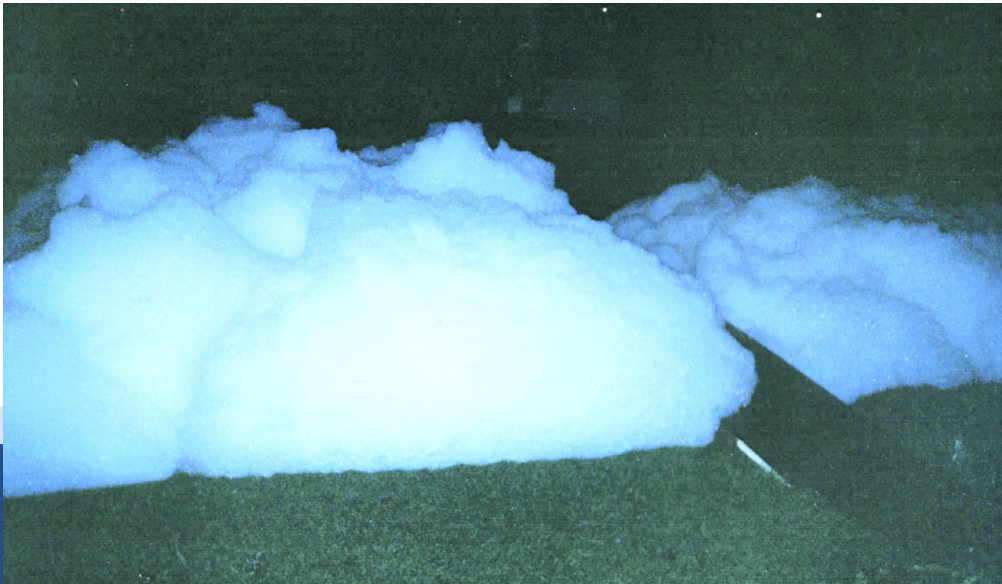


PFAS at Lakewood Water District

PFAS in the regional groundwater supply to the District's wells came from firefighting foam used and disposed at Joint Base Lewis McChord.

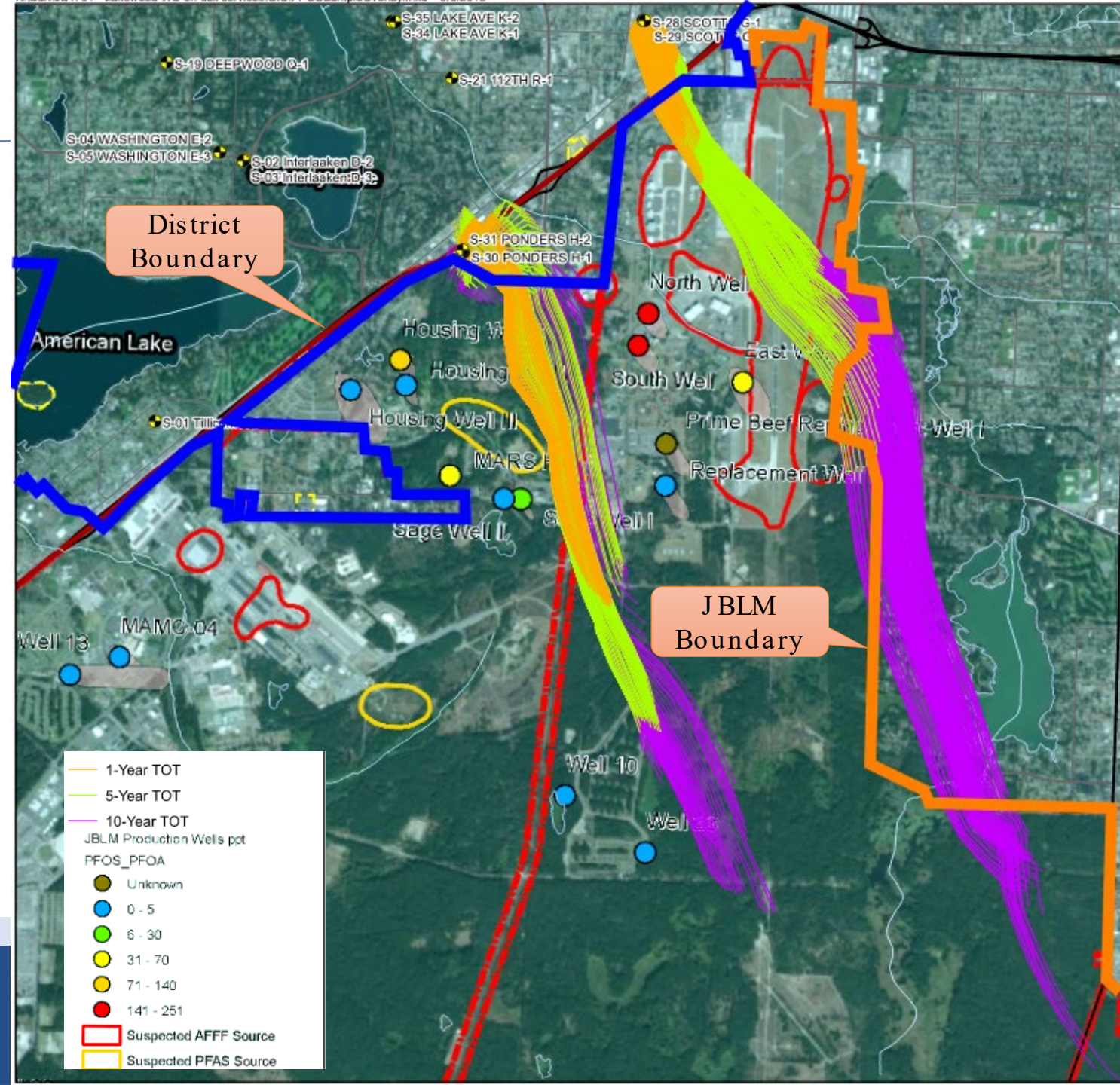


PFAS Foam in Clover Creek



Particle Tracing

- Time of travel (TOT) studies
- Flow path through hangers and runway
- Along path of other impacted wells on base



Response Strategy – Policy Development

- Meet EPA HAL (70 ppt PFOA+PFOS) - No supply shortfalls near and long-term
- Meet WDOH SAL (4 chemicals) - risk of Maximum Day Demand supply shortfall of about 4.8 MGD in 20 years
- Non-detect Policy - supply/demand equilibrium by 2022 and a risk of Maximum Day Demand supply shortfall of about 9.2 MGD in 20 years

**based on 24 hrs. of pumping*



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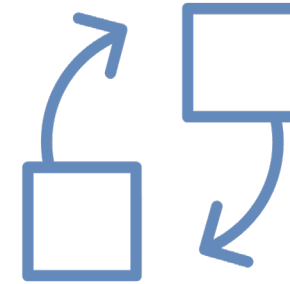
Solution Options - Review



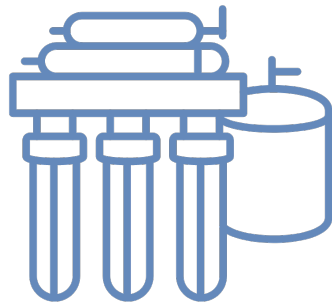
Increase
Production
(temporarily)



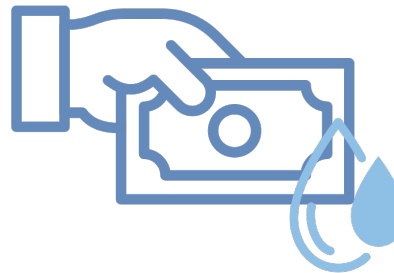
Drill New Wells



Replace Wells



GAC Filtration



Purchase Water



Peak Season Storage

Solution Options – Screening Criteria

- Time –
 - How quickly could solution option be implemented
 - How long would solution option work
- Cost – Capital and Operating Costs
- Quantity – How much water would solution option produce
- Quality – Fe/Mn or PFAS possible/likely
- Uncertainties – Level of confidence in potential solution option
 - Media disposal regulations
 - Contamination of deeper aquifers
 - Well yields

Option Comparison

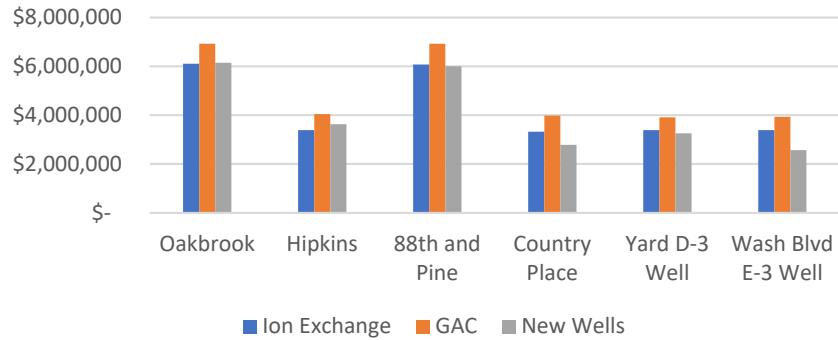
Factor	Drill Well	GAC Filtration	IX Filtration
Initial Construction Costs	Lowest	Highest	High
Ongoing O&M Costs	Lowest	High	Highest
Ability to regenerate media	Yes(1)	Yes	No
Pressure Loss	N/A	Lower	Highest
Physical footprint	Smallest	Largest	Smaller
Potential Production Loss	Yes(2)	No	Small(3)
Potential Production Gain	Yes(2)	No	No

Notes:

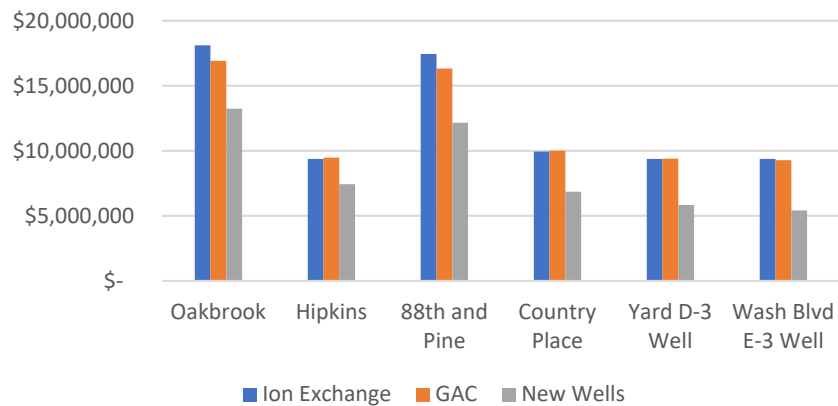
- 1) If Fe/Mn removal required, media can be regenerated
- 2) Yield of well isn't known until well drilling and pump testing
- 3) Pressure loss through filter system reduces flow capacity of existing well pumps

Option Planning Level Cost Comparison

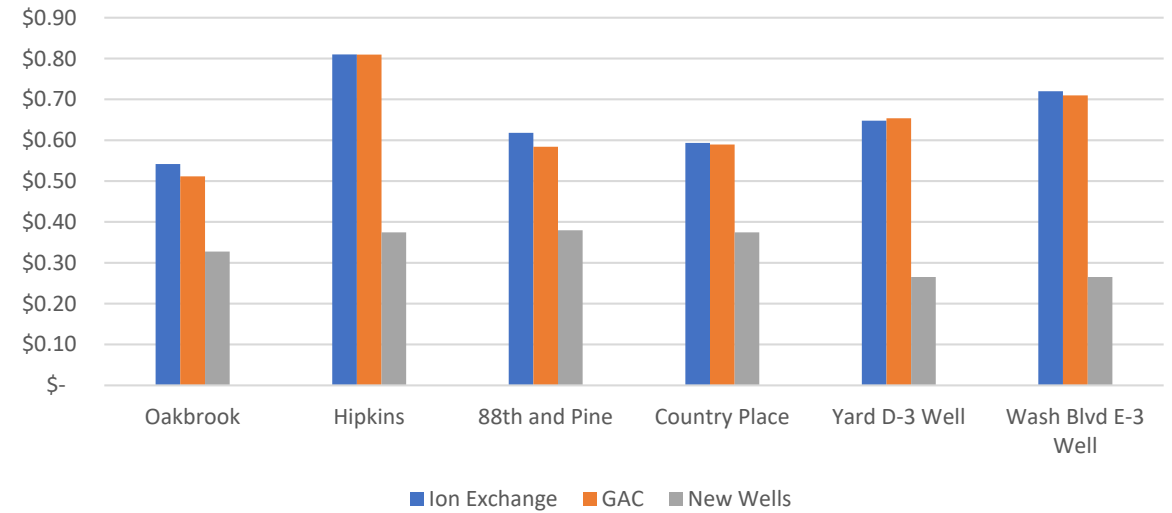
Initial Construction Cost Comparison



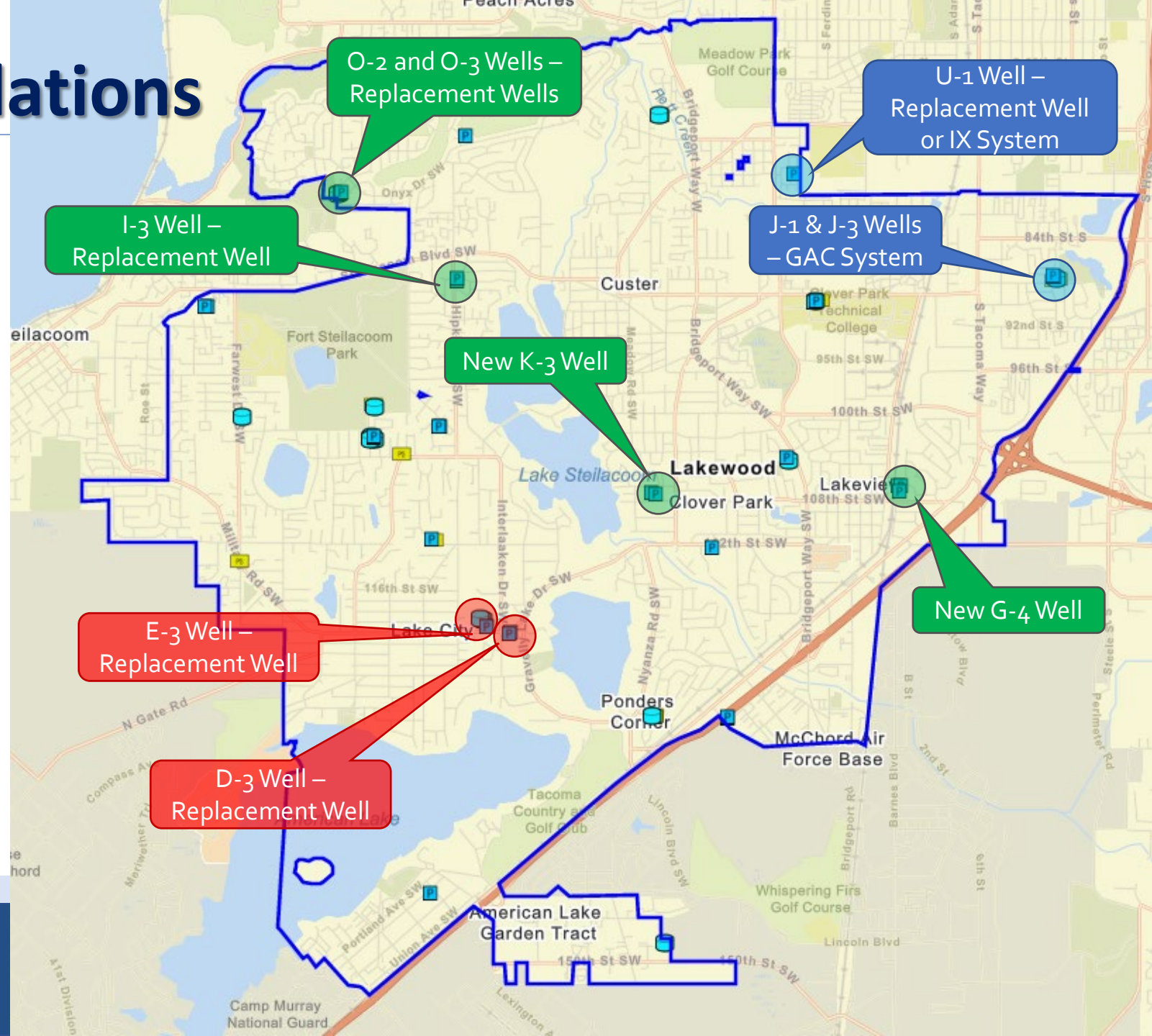
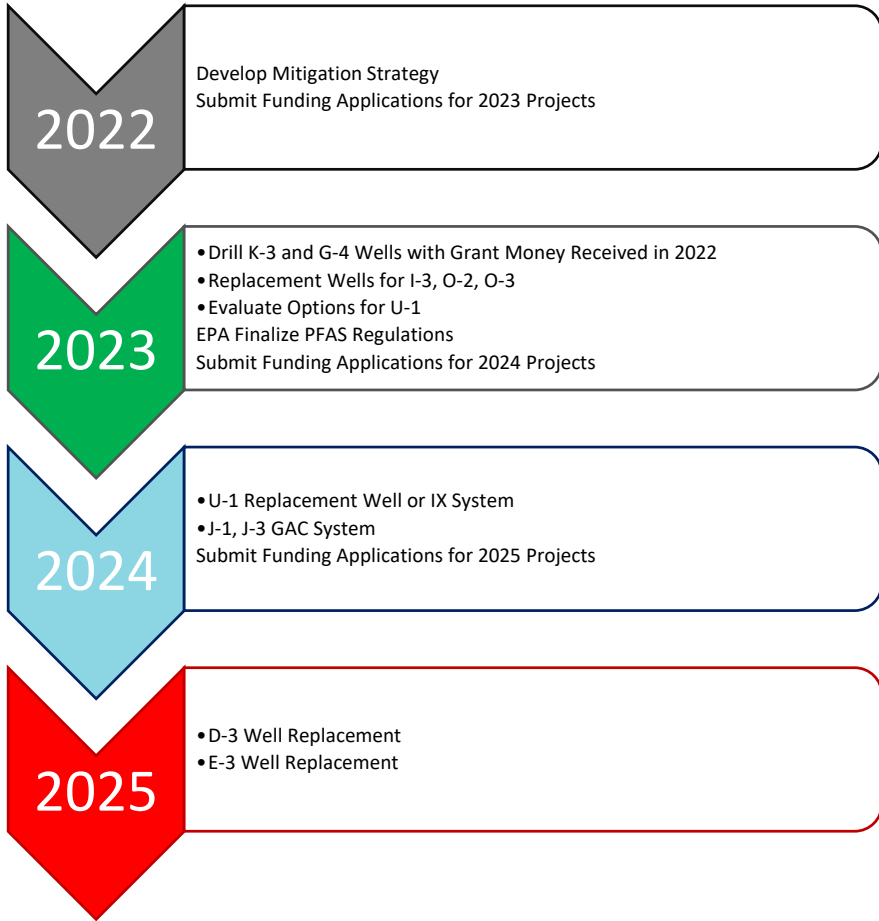
Life Cycle Cost Comparison



O&M Cost per 1,000 Gallons Comparison



Plan Recommendations



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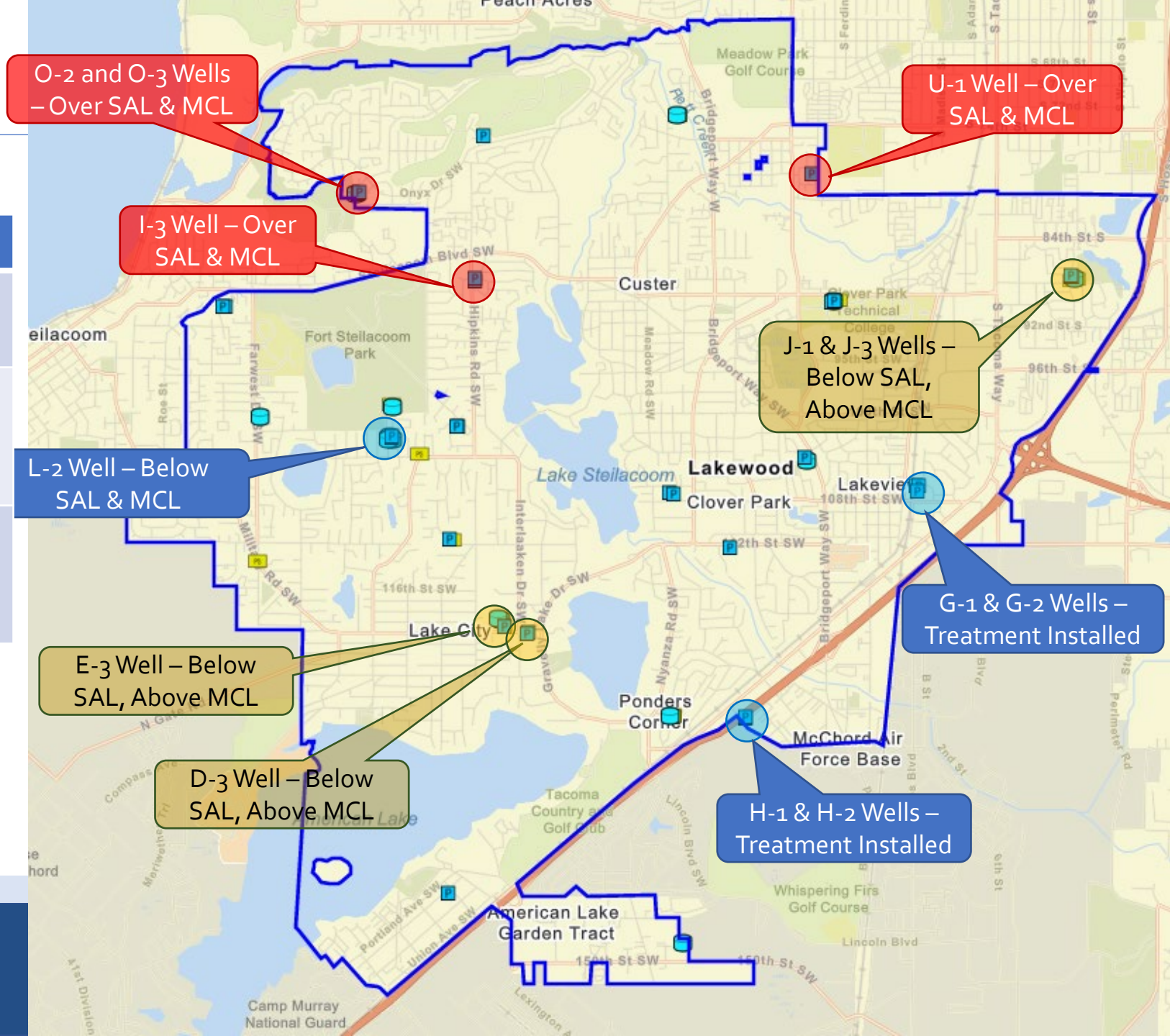
2022

2023



Current Status

Criteria	Wells Impacted
PFAS Detections	13 wells
WDOH SAL	8 above SALs; 4 with treatment; 5 below SALs
EPA Proposed MCLs	12 above MCLs; 4 with treatment; 1 below MCLs

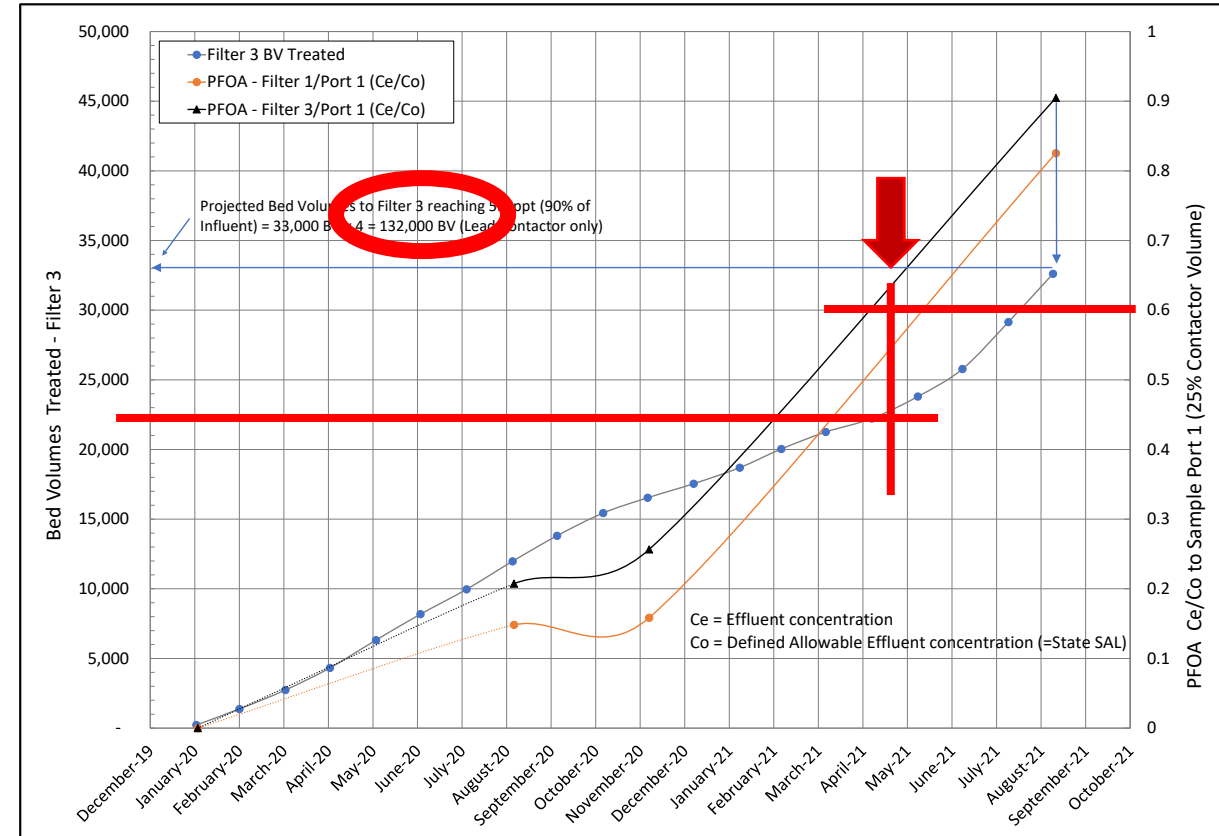
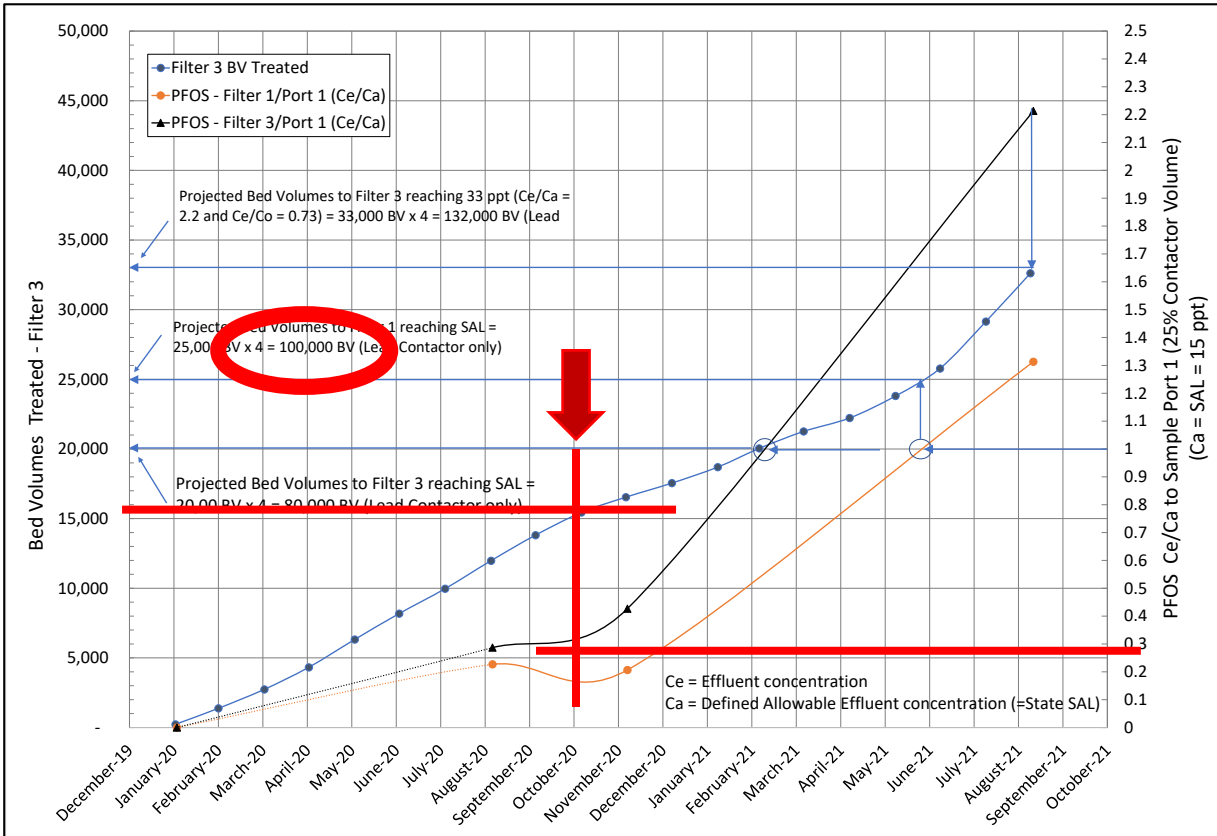


Lessons Learned – GAC Systems

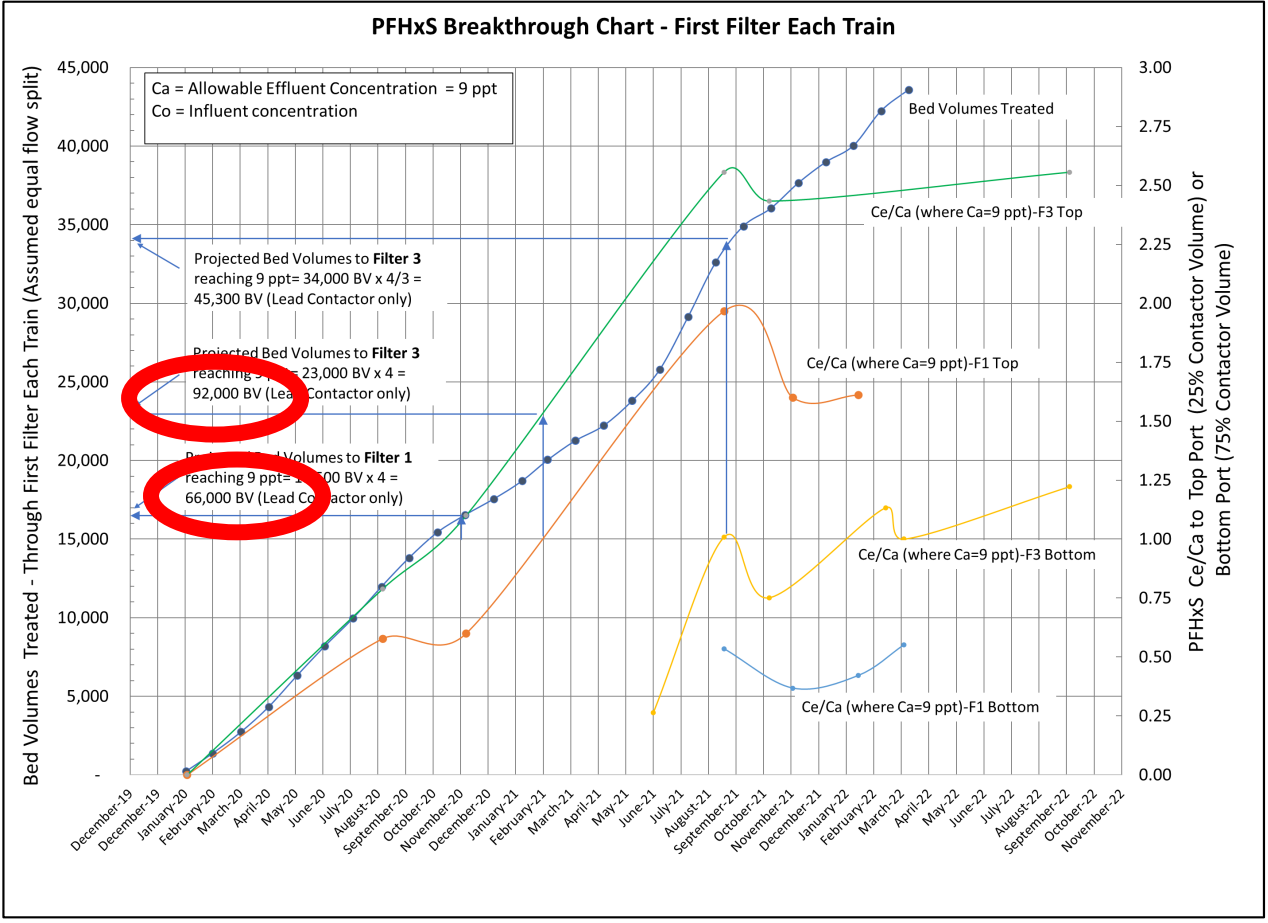
- Arsenic buildup before backwash
- Sample Locations
- Air/Vac maintenance
- Breakthrough curves
- Freeze protection



GAC System Performance



GAC System Performance



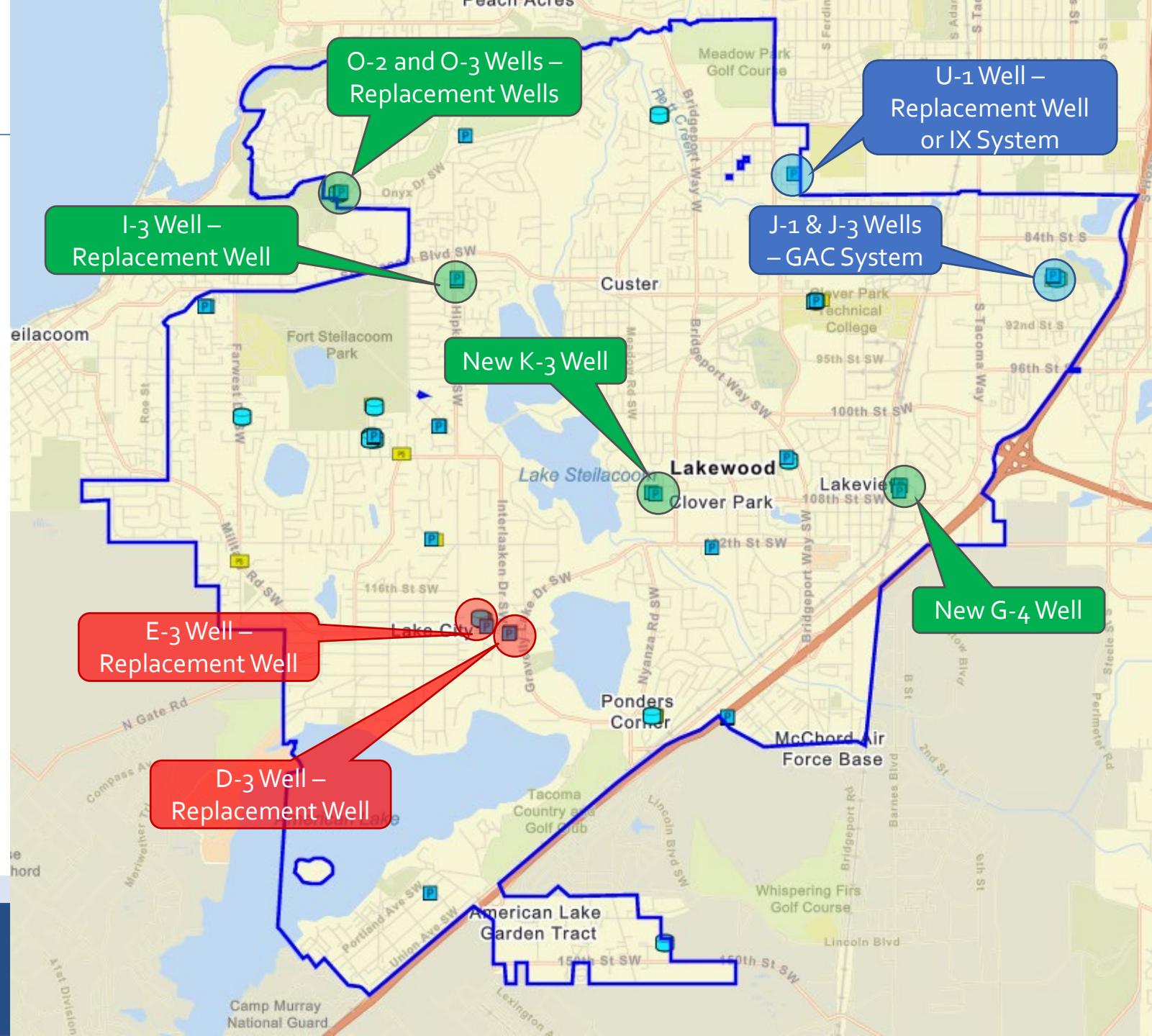
Item	WDOH SAL	Bed Volumes to Breakthrough in Lead Vessel	Months of Operation with Typical Pumping
PFOA	10 ppt	>132,000	73
PFOS	15 ppt	120,000	67
PFHxS	65 ppt	130,000	72
PFNA	9 ppt	--	--
PFBS	345 ppt	--	--
GenX	N/A	--	--

Item	Proposed MCL *	Bed Volumes to Breakthrough in Lead Vessel	Months of Operation with Typical Pumping
PFOA	4 ppt	85,000	47
PFOS	4 ppt	60,000	33
PFHxS	9 ppt	90,000	51
PFNA	10 ppt	--	--
PFBS	2,000 ppt	--	--
GenX	10 ppt	--	--

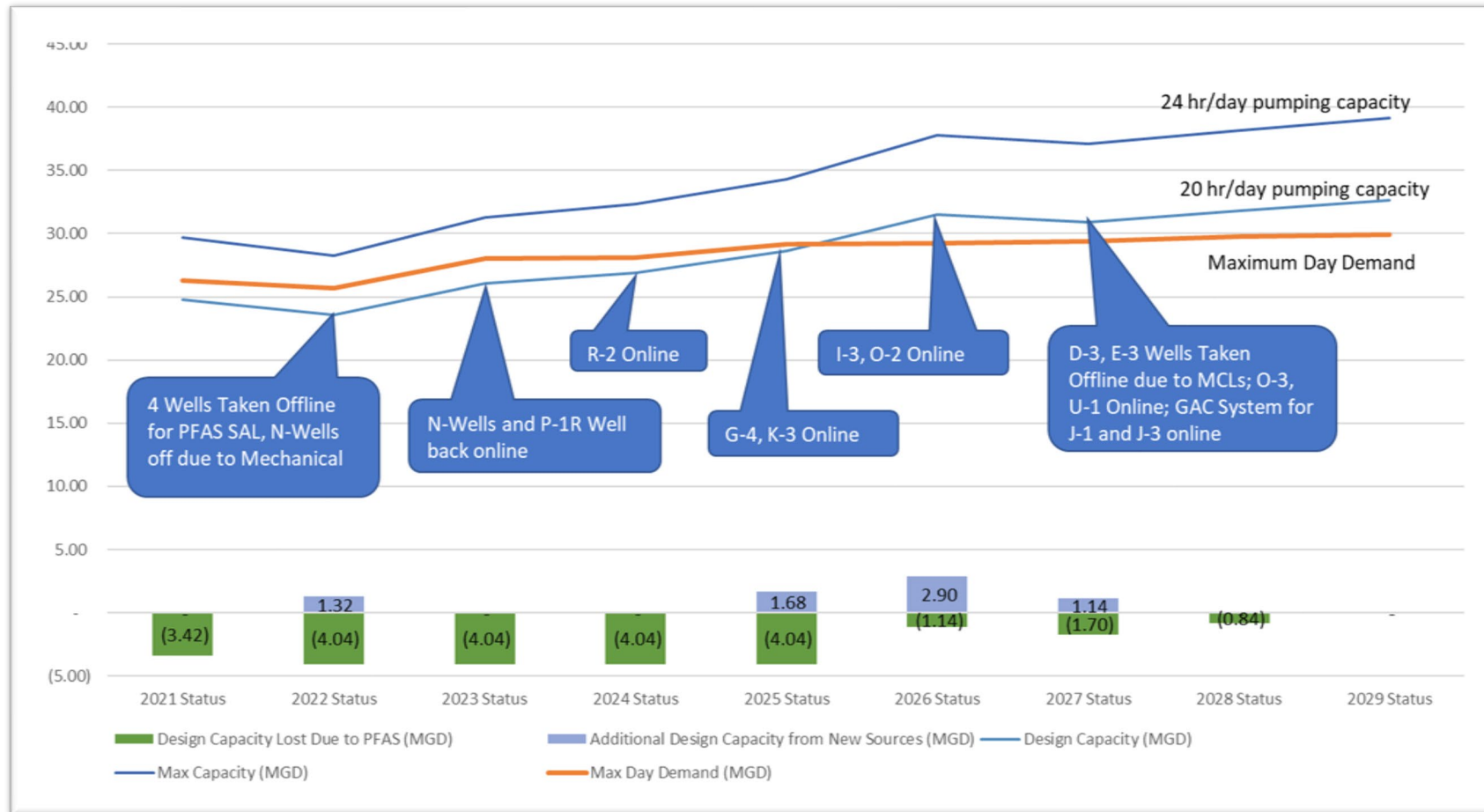


Looking Ahead

- Drilling replacement wells. Senator Murry funding for G-4 and K-3
- Complete remaining Existing Well withdrawal
- Moving from the A/C aquifer to the E aquifer O-2, I-3
- Applying for grant funding and or loans for O-3 and U-1
- Risks Iron/Maganeses treatment
- No water or not enough water



Supply and Demand Projections

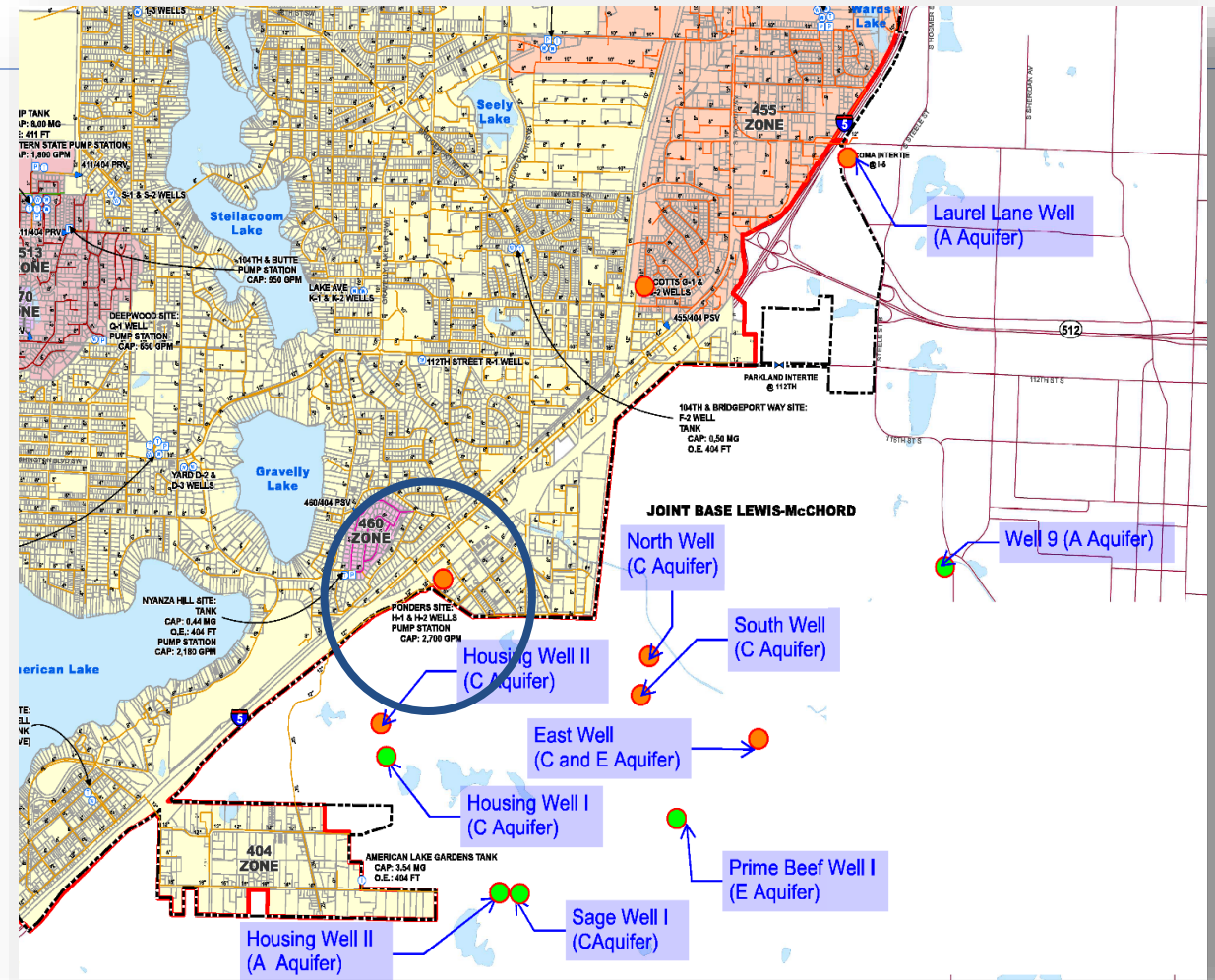


Questions



2016

- Summer of 2016, JBLM press release 5 wells with levels PFAS wells turned off
- 3 wells on McCord
- 2 wells on Ft Lewis
- District sampling in 2016 UCMR 3 low levels Ponders Well site combined 46.5 and 50.5 H-1 & H-2



2017

- DOH notifies LWD of the PFO's in their wells.
- EPA LHAL 70 ppt - UCMR 3 results below PPT
Ponders H-1 & H-2
- Transparency and facts to our customers supported
by Commissioners.
- Increase testing H-1 & H-2 and wells closest to JBLM
- Communicating to customers through newsletter,
annual water quality & business report, and website

WE ARE TAKING ACTION NOW TO:



Protect Your Health

Your water continues to be safe to drink. The water delivered to customers' taps meets all state and federal drinking water regulations to protect public health.



Reduce Cost

The District is seeking every avenue of funding to help pay for water quality protection projects necessary to respond to PFAS.



Ensure a Reliable Water Future

Future reliable water supply options are being evaluated by a team of engineers. The most cost-effective measures will be pursued.



Find Long-Term Solutions

District leadership is working closely with the State of Washington and others on new rules for water treatment and the long-term cleanup of PFAS sites.

2018 thru 2019

- JBLM starts with the CERCLA Process (10-12 years) No still no communication with JBLM (2018)
- Military shut down 5 wells (2018)
- PFAS Sampling of sources varied, monthly, quarterly, and annually. Increase of levels, Board policy of 65 ppt shutoff well. (2018)
- DOH support and worked together messaging (2017-2019)
- Continued transparency with Customers, Speaking to Community Service Groups. Quarterly newsletter, annual report, website. (2017-2019)



2020 thru 2022

- Since 2016 JBLM no cooperation with the District
- Reached out to Senator Murry and Cantwell
- Engaged state legislators in the 28th and 29th
- Lawsuit filed in July of 2020 against the Federal Government and AFFF Manufactures.
- Public out reached campaign. Board letter to Customers. Notice to the press.
- Senator Murry sponsored \$2.0 million for 2 replacement wells through the Direct Appropriation
- WA SAL went into effect on January 1, 2022





Reducing Costs – Lawsuit to recover costs from the US government and PFAS manufacturers

- The District filed a lawsuit on July 16, 2020, against the US Government and the 13 manufacturers of firefighting foam containing PFAS.
- The lawsuit seeks to recover costs that Lakewood Water District has incurred and may incur to complete and maintain water quality protection projects in response to PFAS.
- The lawsuit seeks to recover past, current, and future costs related to the District's water protection projects in response to PFAS.
- The costs claimed include infrastructure upgrades, additional testing, attorneys' fees, and relief for any future actions needed to address PFAS and continue to provide a safe and reliable water supply to our customers.
- Over 900 bases with PFAS with over 500 lawsuits!
- Whidbey Island NB, Fairchild AFB, Yakima Firing Range, JBLM, and Bangor NB



Protecting Health Actions at Ponders Wellsite

Ponders was the first wellsite to approach EPA lifetime health advisory levels

- The well was immediately turned off and removed from service May 2018
- It took around 18 months to design and install a granular activated carbon (GAC) treatment system—the project was completed in November 2019.
- GAC is a highly effective treatment—there is no detectable PFAS left in GAC-treated water at Ponders.





Protecting Health Actions at Scotts Wellsite

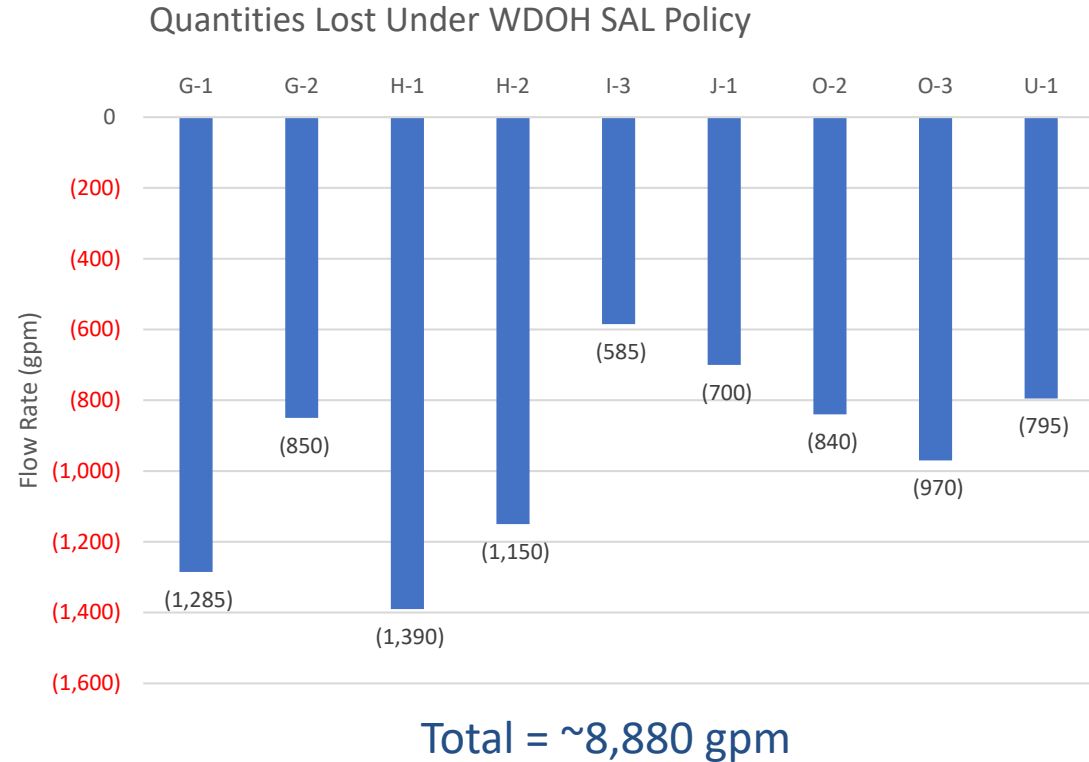


Scott Wellsite has one well with PFAS levels slightly above the EPA lifetime health advisory levels.

- The well has also been taken turned off and taken out of service.
- An additional new well was drilled in the hopes of increasing capacity of the wellfield with non-PFAS impacted water.
- \$5.56M received in funding from Senator Murry
- New well has no PFAS but has elevated levels of iron and manganese and not enough capacity to reduce the overall level of PFAS from the wellfield (blending).
- The District is designing a GAC filtration for this wellfield (2 wells) and will still use the new well for additional capacity.

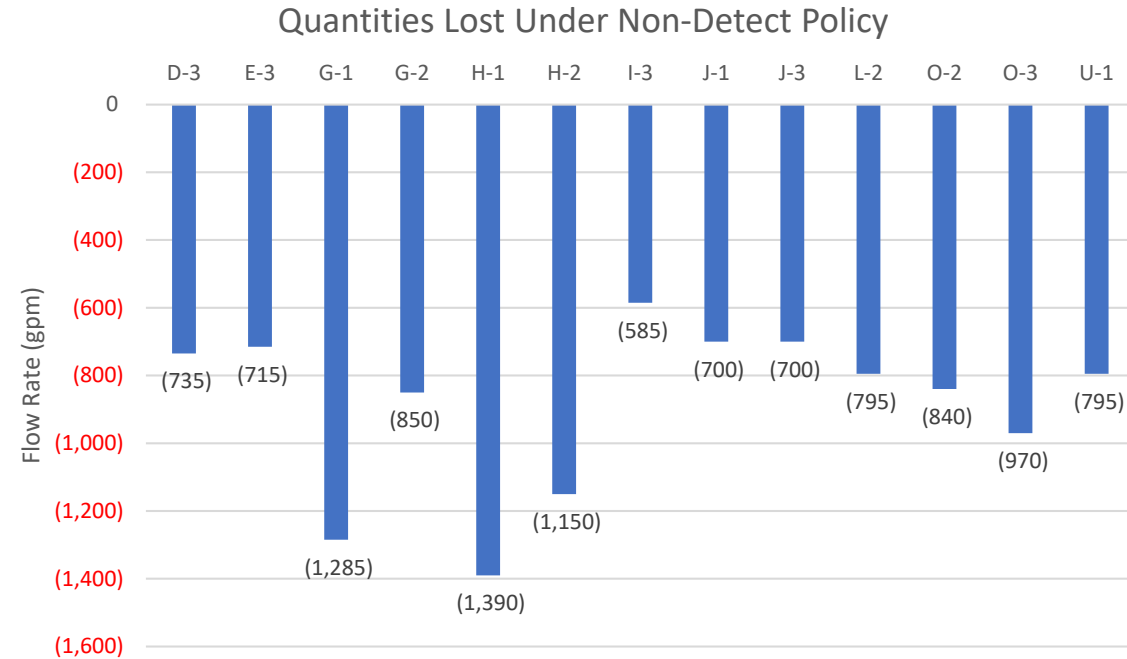
9 Wells (at 6 Sites) Impacted Under WDOH SAL Policy

1. Scotts (G-1 and G-2)
2. Country (U-1)
3. 88th & Pine (J-1)
4. Oakbrook (O-2 and O-3)
5. Hipkins (I-3)
6. Ponders (H-1 and H-2)



13 Wells (at 9 Sites) Impacted Under Non-detect Policy

1. Yard (D-3)
2. Washington Blvd (E-3)
3. Scotts (G-1 and G-2)
4. Ponders (H-1 and H-2)
5. Hipkins (I-3)
6. 88th & Pine (J-1 and J-3)
7. Hemlock (L-2)
8. Oakbrook (O-2 and O-3)
9. Country (U-1)



Total = ~11,940 gpm

5 Untreated Wells (at 3 Sites) Impacted Under WDOH SAL Policy

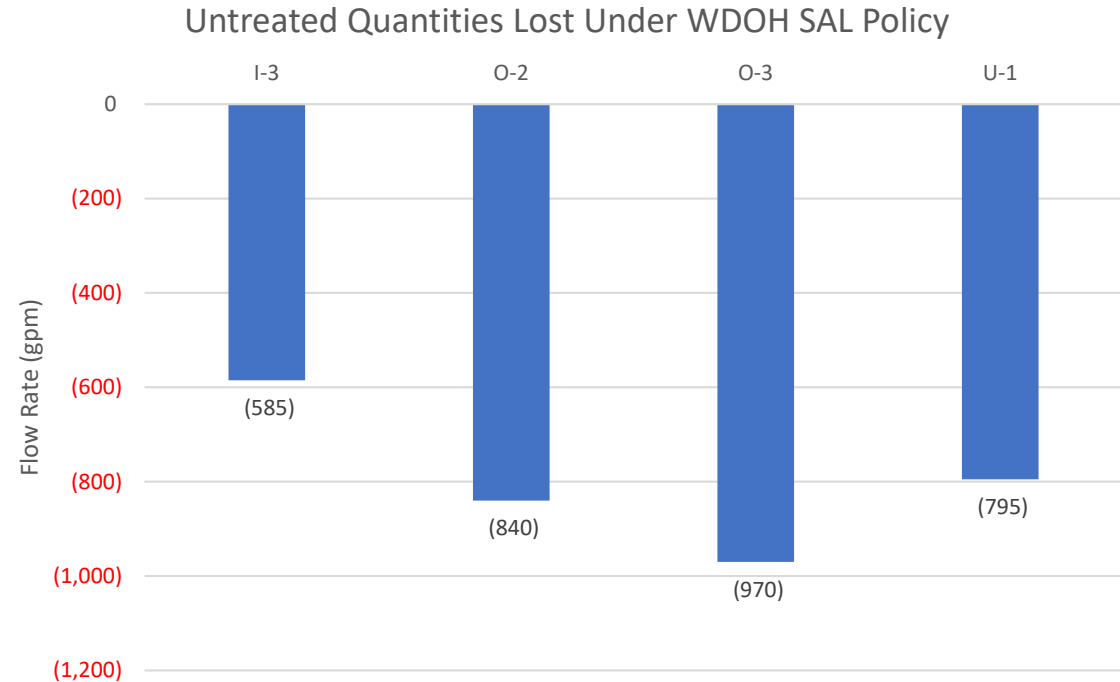
1. Country (U-1)
2. Oakbrook (O-2 and O-3)
3. Hipkins (I-3)

Sites with Treatment

1. Ponders (H-1 and H-2)
2. Scotts (G-1 and G-2)

Site with Blending

1. 88th & Pine (J-1)



Total = ~3,190 gpm

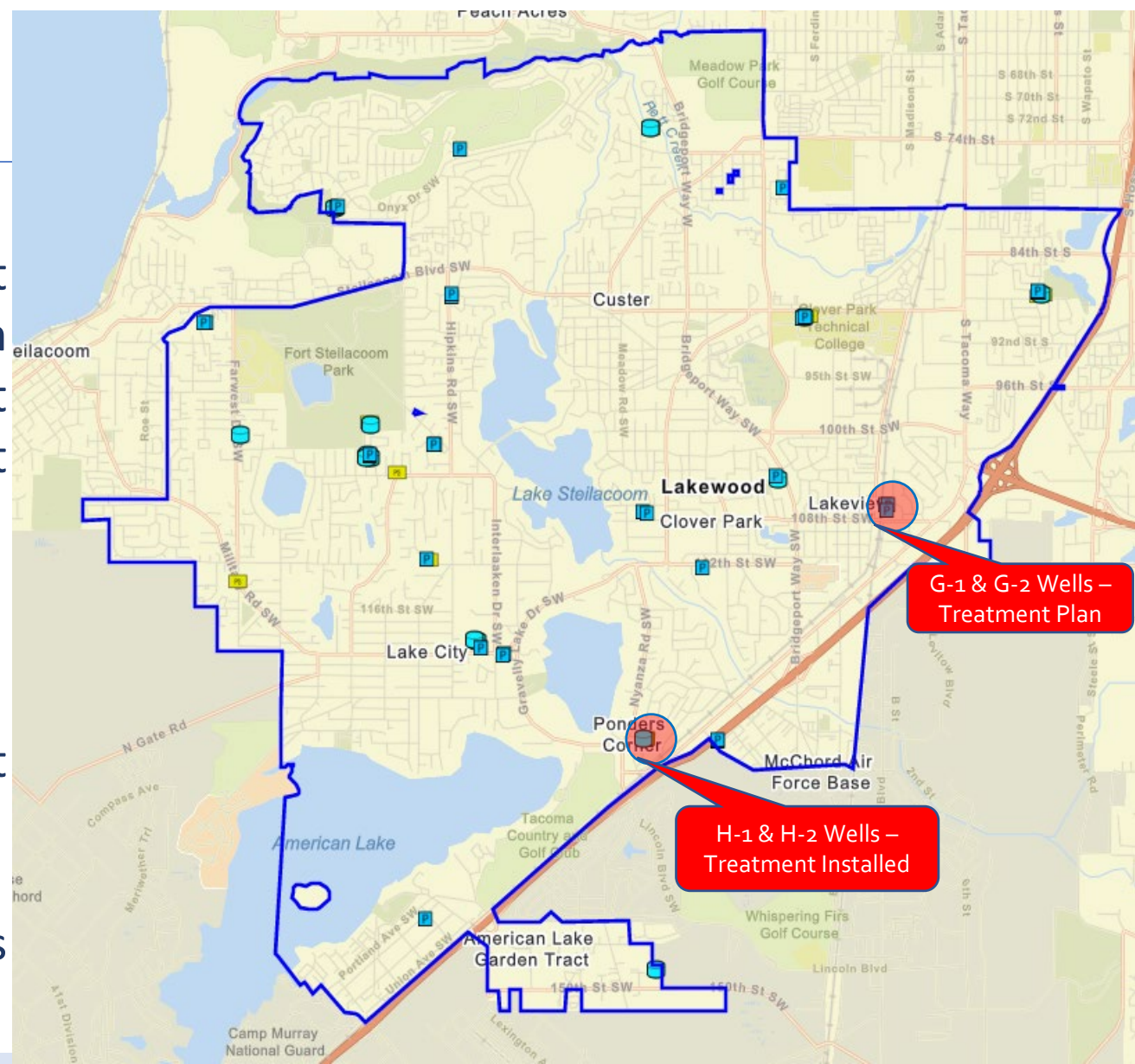
Aquifers Flow and Wells Affected EPA LTHAL 2018-19

2018 - Ponders Wellsite H-1 & H-2 were at 63 ppt & the Board of Commissioners decided to turn wells of at 65 ppt. Due to the levels nearing 65 ppt was decided to turn off the wells until the District could install a GAC treatment system.

2018 - Scotts Wellsite also had detection of PFAS.

2019 - Ponders Wellsite H-1 & H-2 GAC treatment was installed and turned on.

2019 - Scotts Wellsite G-3 new well project was awarded



Demand Projections

Maximum Daily Demands (MDD) and Capacity of Existing and Currently Planned Sources

