PFAS Management Update

DSRSD Board Meeting

March 18, 2025

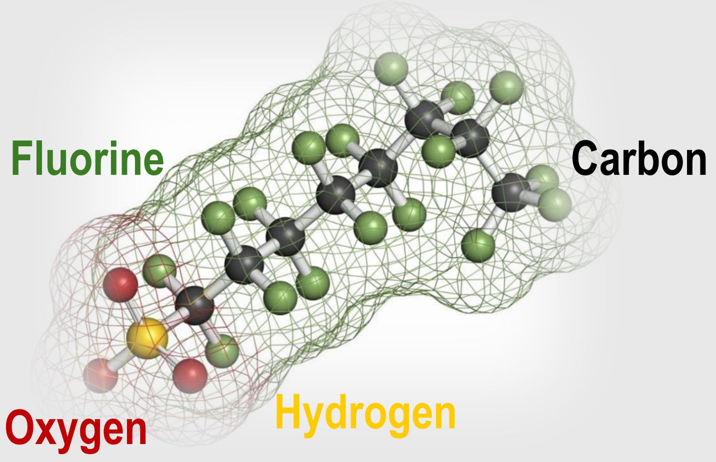
Today's Topics of Discussion

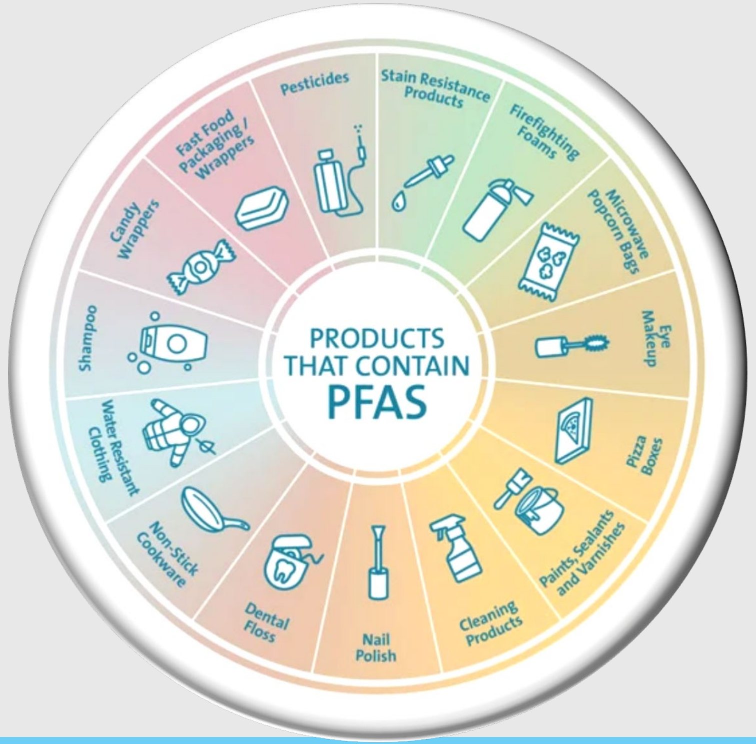
- About PFAS?
- Why does Zone 7 manage PFAS?
- What is Zone 7's PFAS Management Strategy?
- What has Zone 7 accomplished to date?
- What are the key takeaways and planned next steps?

ZONE 7 WATER AGENCY

About PFAS: Per- and Polyfluoroalkyl Substances

- Accidentally discovered by Roy J. Plunkett in 1938 at DuPont lab
- Manufactured since 1940s
- >14,000 known compounds
- PFOA and PFOS are most common and well-studied
- PFAS are anthropogenic compounds which are structurally stable, so they do not degrade in the environment
- Highly mobile in water
- Since the 1940s, they have been commonly used in consumer products and industrial processes.
- Serious effects on human and ecological health.





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Why does Zone 7 manage PFAS?

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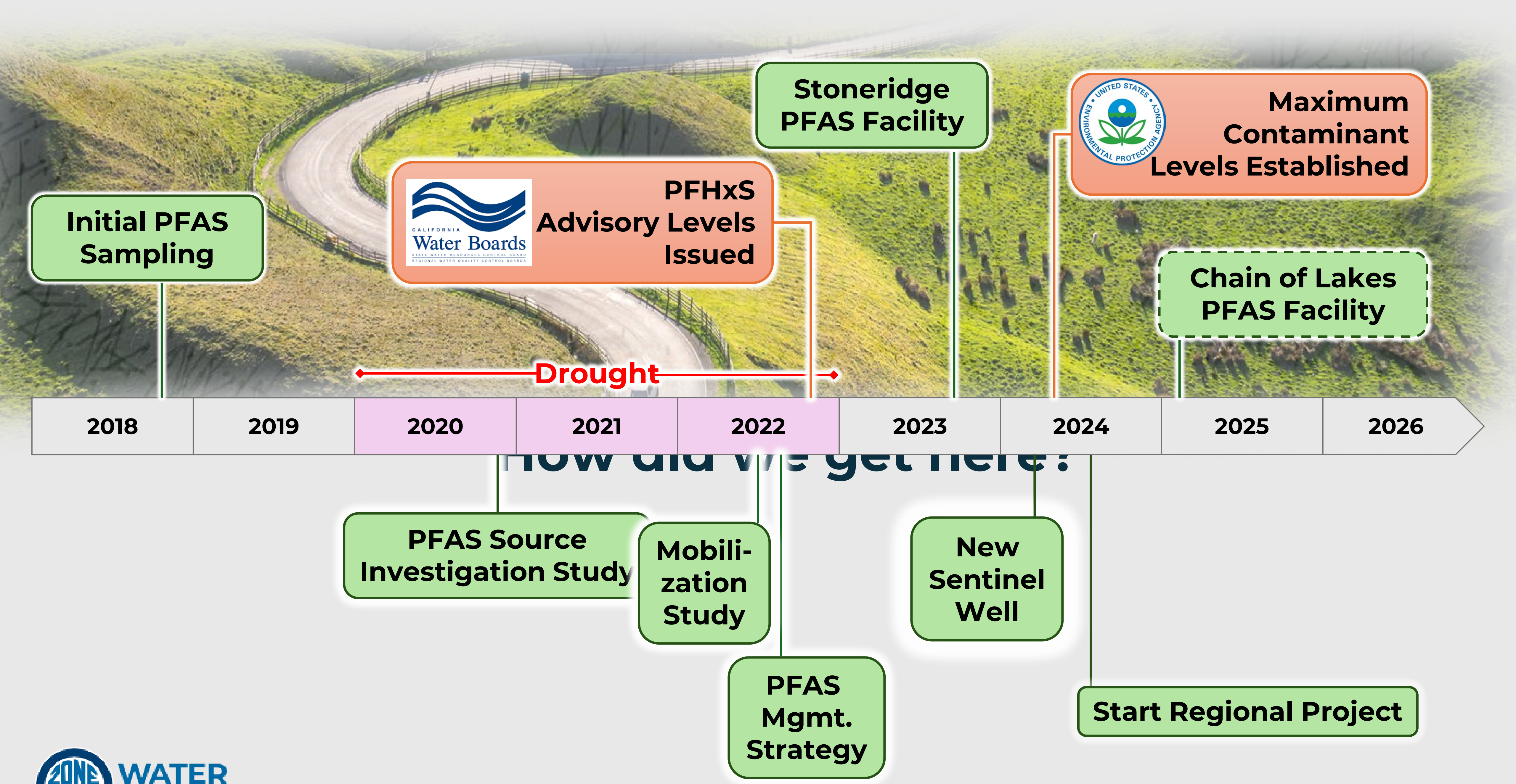
Zone 7's PFAS Management Objectives

1. To support the mission of delivering safe, reliable, efficient, and sustainable water
2. Policy Requirements and Regulatory Compliance Needs
3. To manage local groundwater supply to remain resilient to multiyear droughts
4. To meet or exceed State and Federal Drinking Water Quality Standards
5. To sustainably manage the groundwater basin in compliance with the Sustainable Groundwater Management Act



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US Environmental Protection Agency's Regulatory Actions

- **On April 10, 2024**, EPA announced the final **National Primary Drinking Water Regulation** (NPDWR) for six PFAS. With this regulation, EPA established legally enforceable Maximum Contaminant Levels (MCLs) and a Hazard Index.
- **By 2027**, monitor for these PFAS and have three years to complete initial monitoring, followed by ongoing compliance monitoring.
- **In 2027**, provide the public with information on the levels of these PFAS in their drinking water.
- **By 2029**, implement solutions that reduce these PFAS if monitoring shows that drinking water levels exceed these MCLs.
- **Beginning in 2029,** take action to reduce levels of these PFAS and provide notification to the public of the violation.

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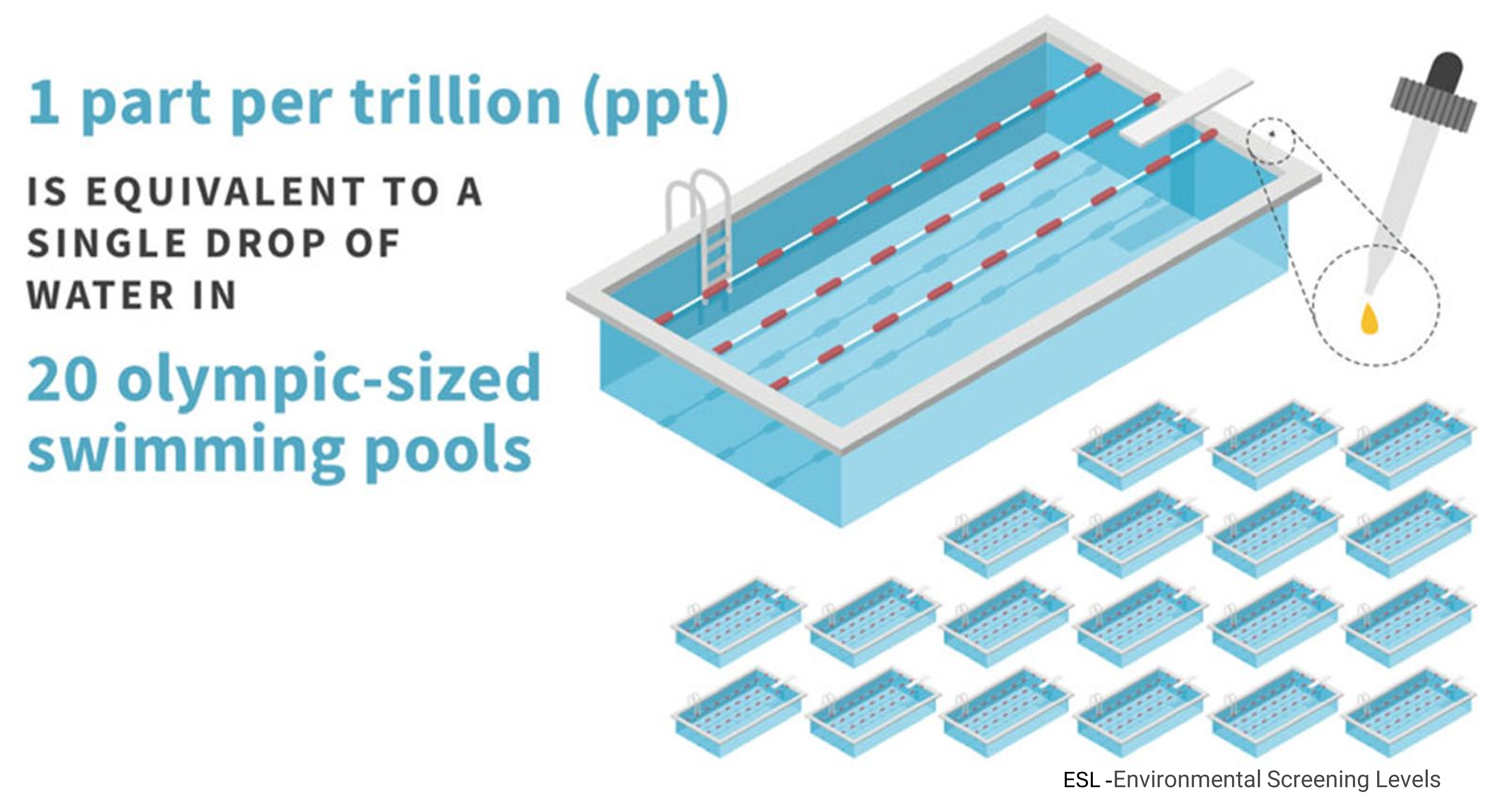
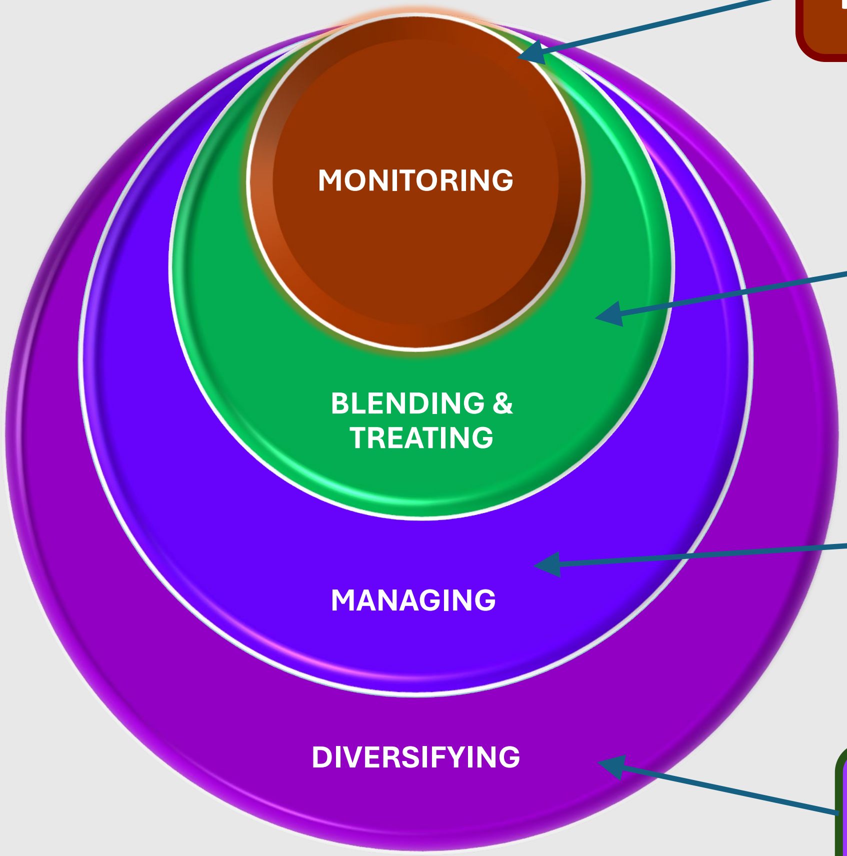
2024 Final PFAS Maximum Contaminant Levels



ESL -Environmental Screening Levels

What is Zone 7's PFAS Management Strategy?

Zone 7's Long-term PFAS Management Strategy* (Post 2023)



MONITORING to track and manage groundwater quality

BLENDING & TREATING to meet water quality standards

MANAGING GROUNDWATER QUALITY to prevent further degradation

DIVERSIFYING GROUNDWATER SOURCES to become more resilient

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* This strategy is internally developed by Zone 7 in 2022.

Monitoring Component

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Monitoring

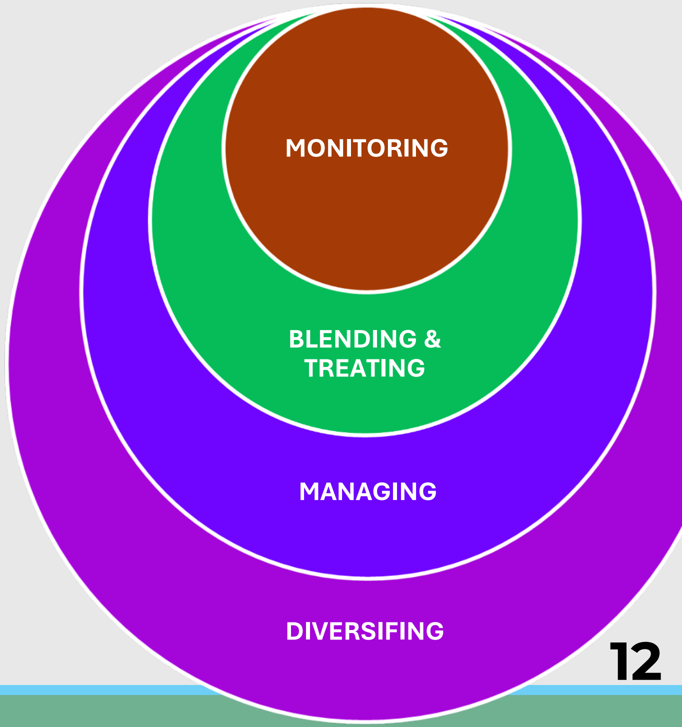
To track and manage groundwater quality

Completed Actions:

- Expanded PFAS monitoring network from 67 wells in 2021 Water Year to 107 In 2023 Water Year
- Installed a sentinel well in Ken Mercer Park to observe the Bernal subbasin (2023)

Ongoing Actions:

- Implementing the PFAS monitoring program to track the PFAS concentrations
- Sharing data with retailers and regulators to investigate the source(s)
- Making PFAS data and information available to the public for transparency



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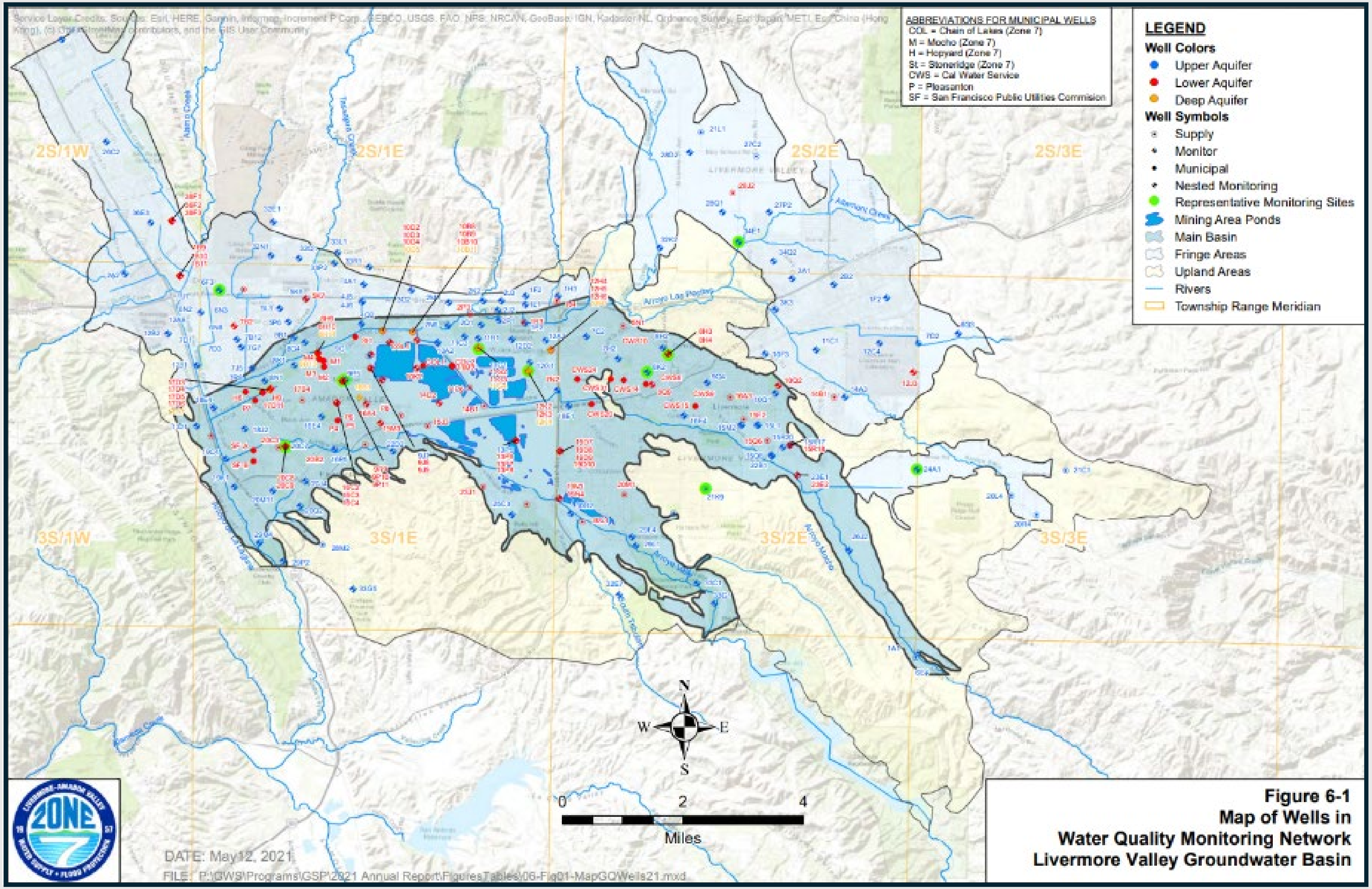
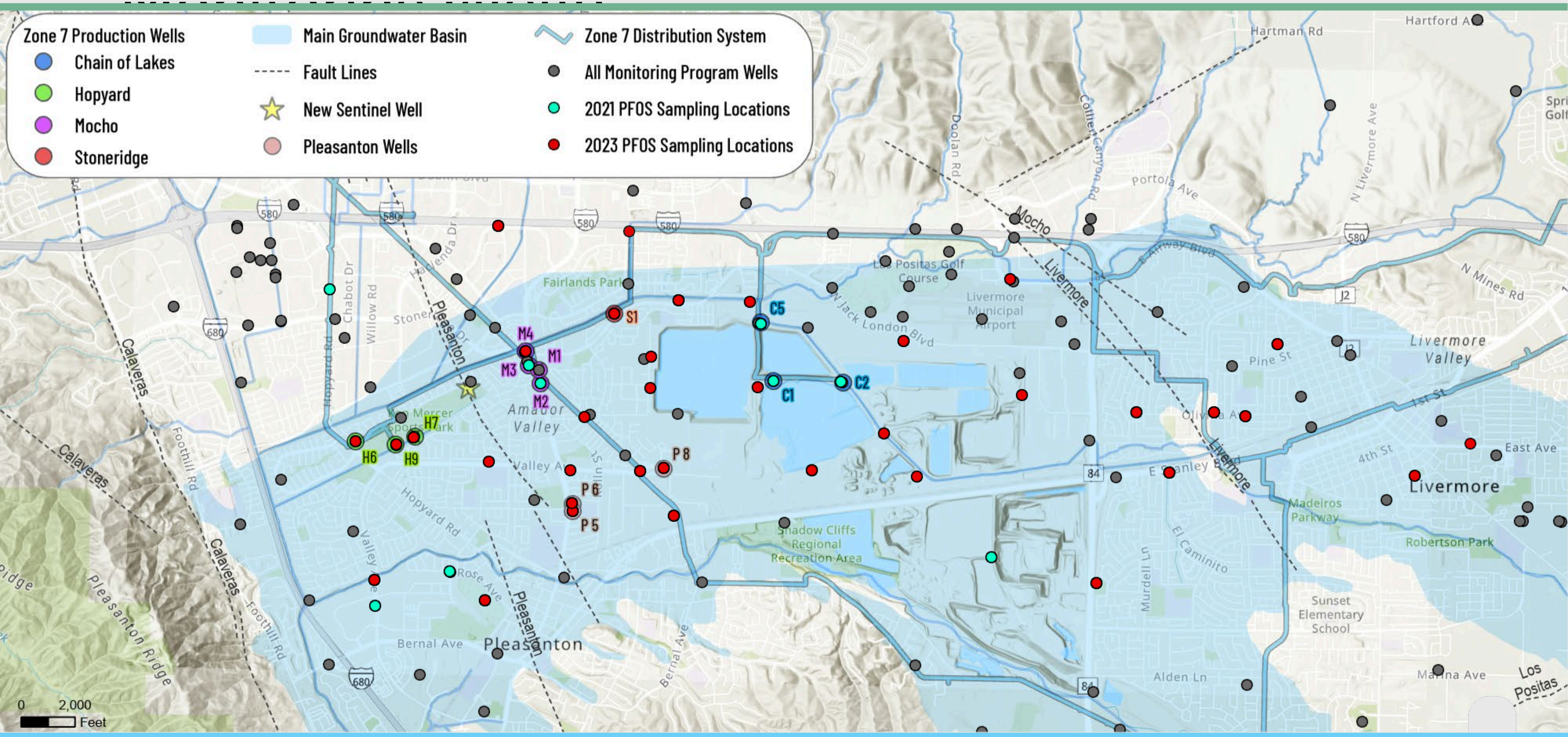
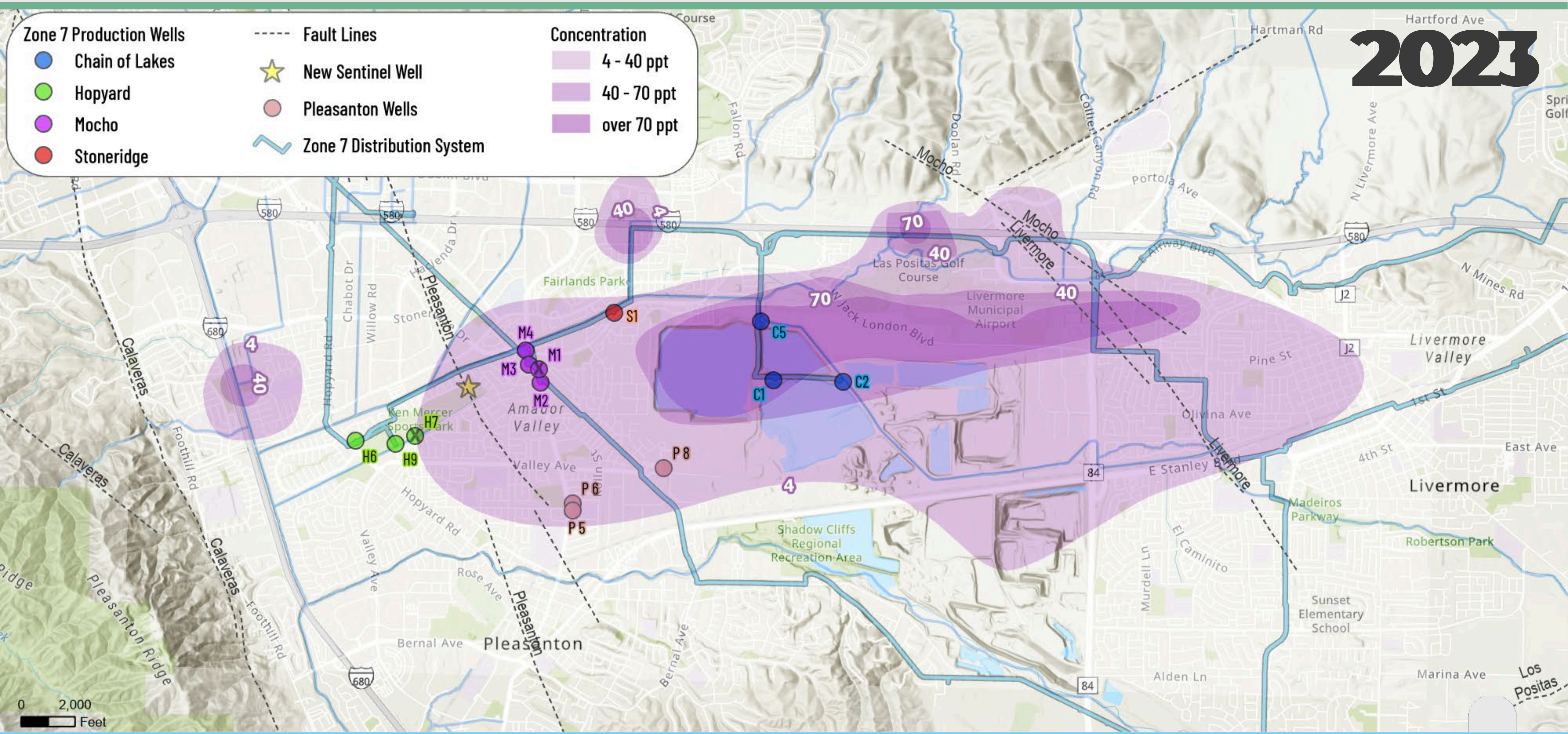
Water Quality Monitoring



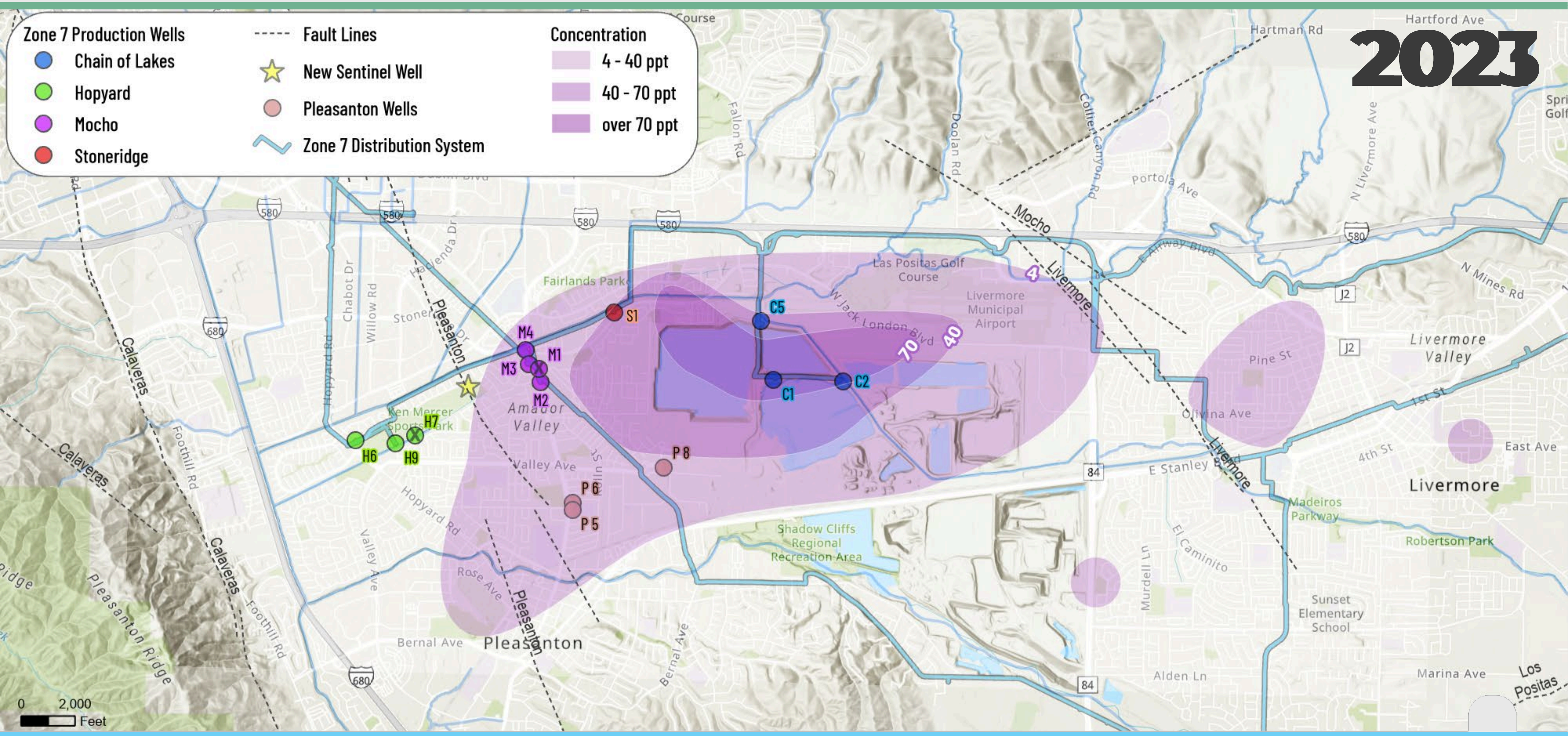
PFAS Monitoring Well Network



Upper Aquifer PFOS Footprints (2021 and 2023)



Lower Aquifer PFOS Footprints (2021 and 2023)



Blending & Treating Component

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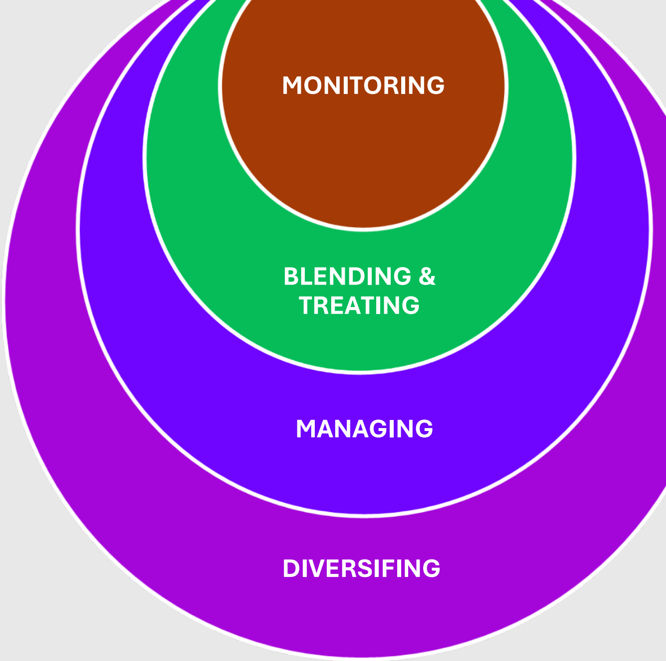
Blending and Treating

To meet current and future water quality standards



Completed Actions:

- Installed Ion Exchange PFAS Treatment at the Stoneridge Well facility
- Increased use of surface water.

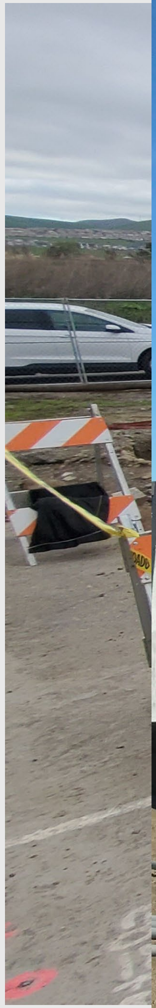
Ongoing Actions:

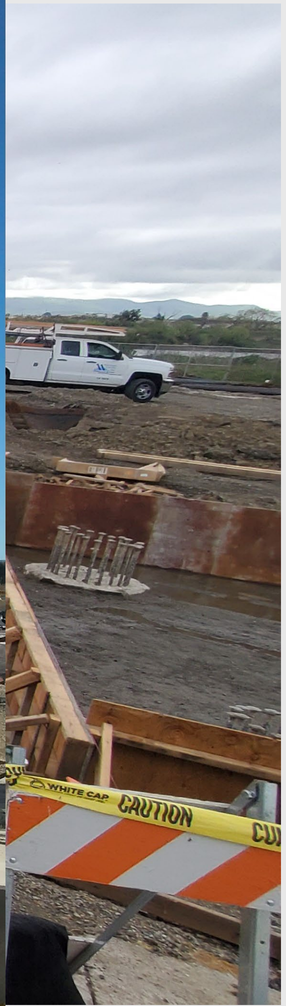
- Meeting primary water quality standards
- Optimizing blending and treating to gain operational efficiency
- Constructing Ion Exchange PFAS Treatment facility at the Chain of Lakes Facility to be commissioned in early 2025
- Reduced the production of our Mocho wellfield by nearly two-thirds
- Started a conceptual design for a Mocho PFAS treatment facility with the goal of having the facility online in coming years

ZONE 7 WATER AGENCY

Managing PFAS Concentrations by Wellhead Treatment

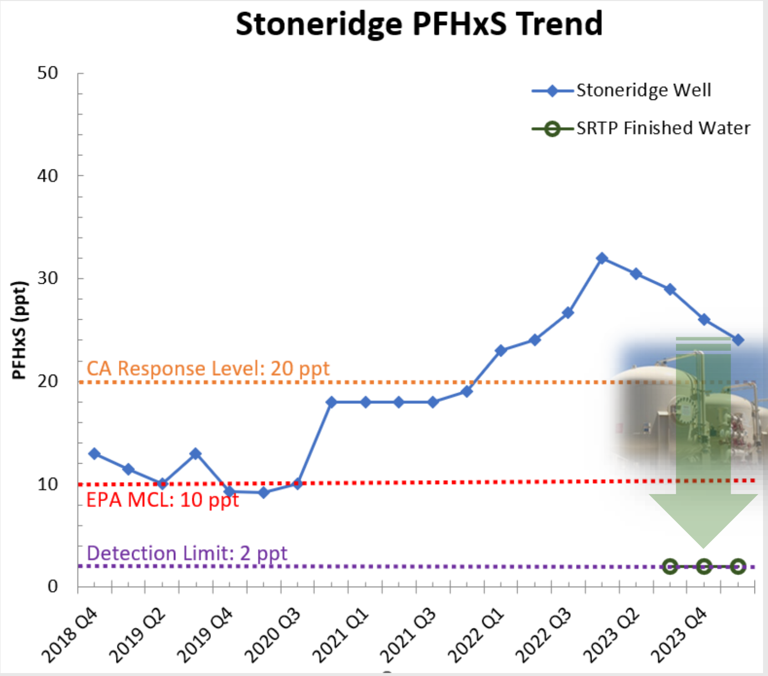
Chain-of-

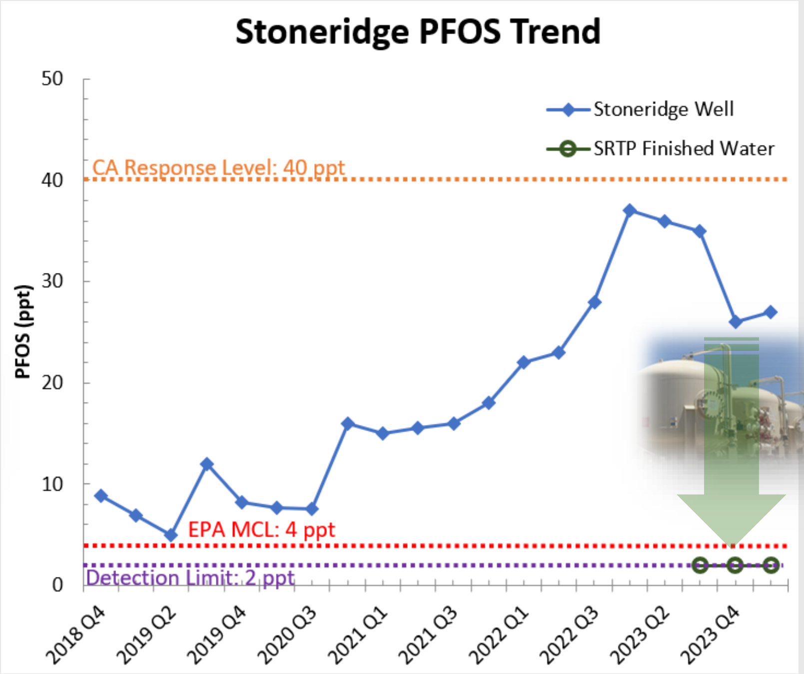


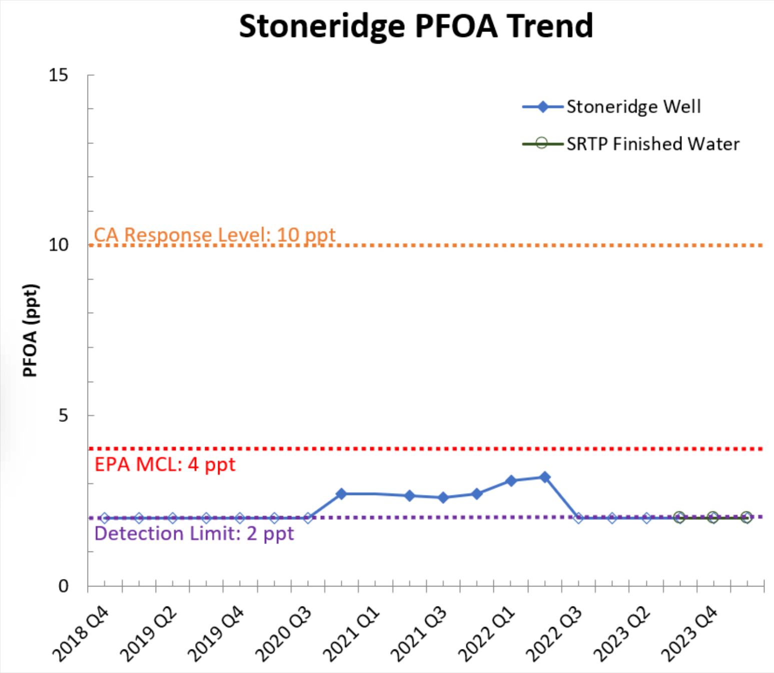


ZONE 7 WATER AGENCY

Effectiveness of Ion Exchange PFAS Treatment at Stoneridge







Managing Groundwater Quality Component

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MANAGING GROUNDWATER QUALITY

To extent possible, prevent water quality degradation and potential mobilization

Completed Actions:

- Analyzed feasibility of injecting Mocho 1 to dilute and/or impede the concentration (Determined it's no longer feasible)
- Commenced Stoneridge facility operations
- Recharged the basin with imported surface water

Ongoing Actions:

- To extent possible, prevent water quality degradation and potential mobilization
- Increase the water quality protection by more stringent well permitting
- When completed, operate Mocho Demineralization facility, Stoneridge and COL PFAS Treatment Facility to pump and treat the concentrations

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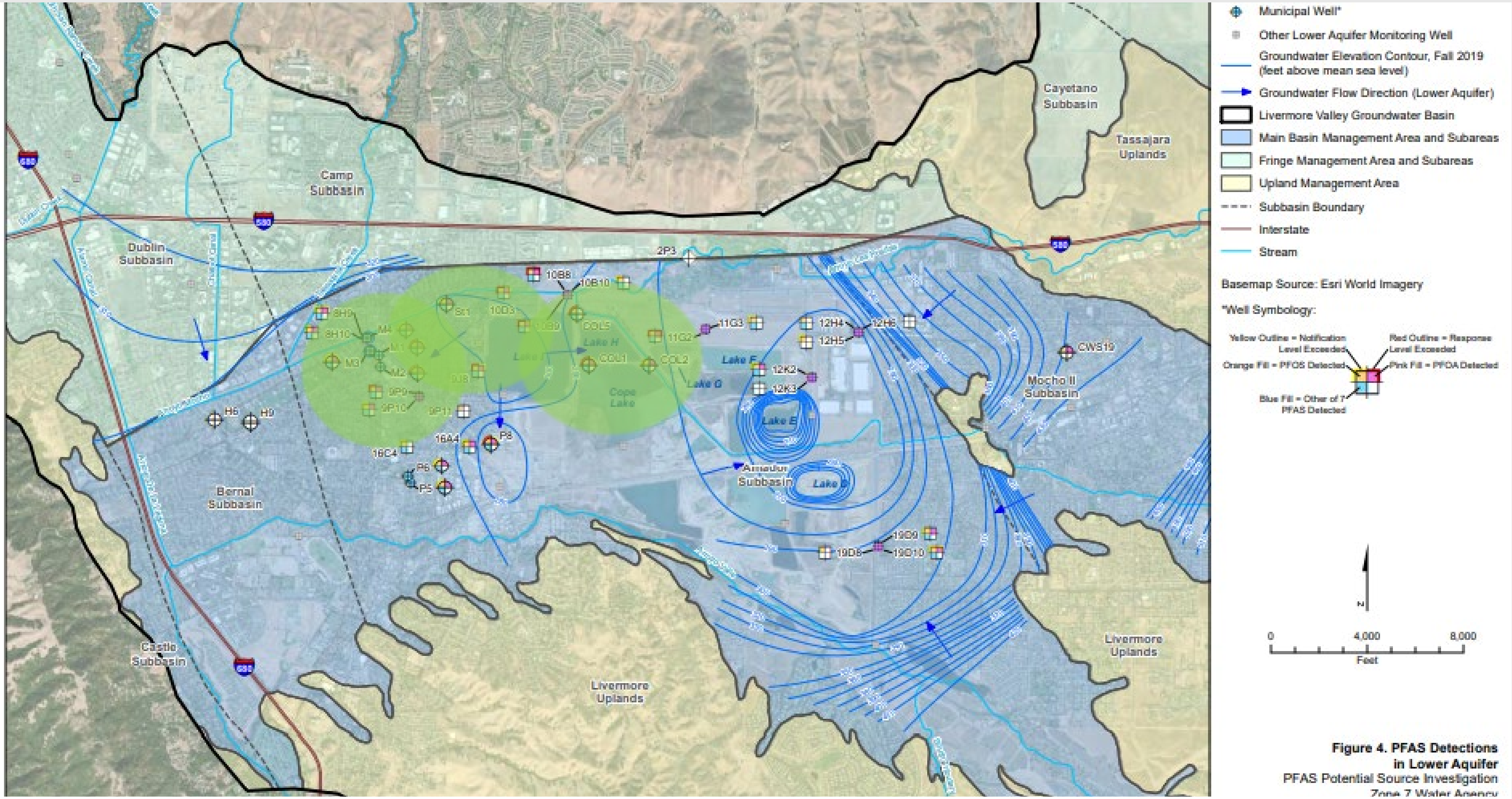
Managing PFAS by Pump and Treat



Note: Illustration of the pump & treat concept only but not absolute values.

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Simulations of Pump & Treat of PFAS @ COL 1, 2, 5 and Mocho Well Fields (2022)

Effectiveness of simulated pump & treat in Upper Aquifer

Effectiveness of simulated pump & treat in Lower Aquifer

Diversifying Groundwater Sources Component

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Local Water Resources

DIVERSIFING ~~GROUNDWATER SOURCES~~

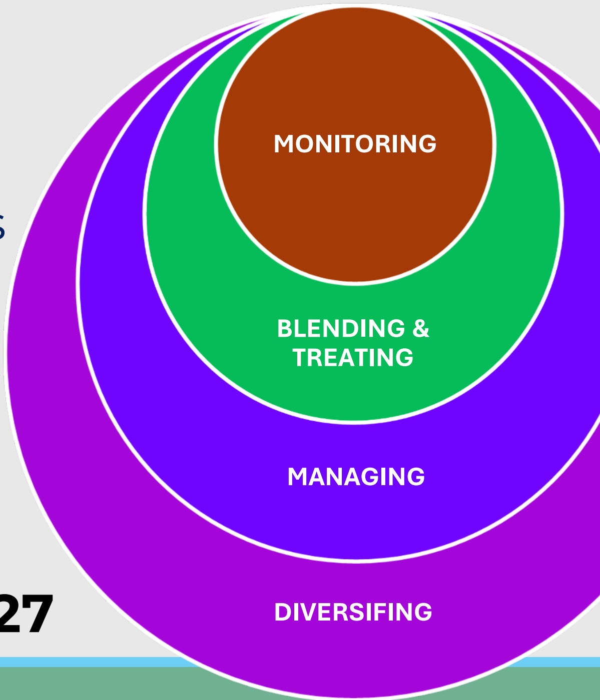
To become more resilient to droughts and emergencies

Completed Actions:

- Recharged the groundwater basin to 100% full
- Updated water supply planning with the latest SWP allocation

Actions to be taken in coming years:

- Update the 2003 well master plan (FY25-26)
- If feasible, add new wells to diversify the GW sources and remain sustainable
- Conduct a feasibility study of a local storage and conveyance project in the Chain-of-lakes complex
- Conduct Water Supply Evaluation in coming years to diversify water supplies and respond to changing climate



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What are the key takeaways and next steps?

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Key Takeaways

1. PFAS is **ubiquitous** in the environment and generally everywhere
2. PFAS most likely comes from **multiple legacy sources and ongoing domestic discharges**
3. Complete **elimination of source(s) is almost impossible** until PFAS is totally removed from consumer products
4. Increased **monitoring could reveal** previously unknown PFAS concentrations, and footprint
5. Groundwater recharge and pumping & treating can change PFAS concentrations
6. Wet year hydrology can influence PFAS concentrations
7. Ongoing monitoring, pump & treat operations, and modeling are helpful to study and manage PFAS better, but **need to prepare for eventual well head treatment** for PFAS and other emerging contaminants
8. Public outreach efforts to inform the public of **factual information is essential**
9. Meeting the drinking water **MCLs is at the point of compliance** of the distribution system but not in the basin or not at the wells

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Zone7's Planned Next Steps

1. Continue monitoring
2. Continue coordinating with the San Francisco Regional Water Quality Control Board to investigate potential source(s)
3. Share information with the State Board's Division of Drinking Water
4. Complete upgrading the GW model (FY25) and analyze PFAS concentrations
5. Complete construction of the COL PFAS treatment facility (FY25)
6. Proceed with the Regional Project feasibility study to diversify the groundwater supply sources (FY25)
7. Develop a basin wide water quality management plan (FY26)
8. Update the Well Masterplan (FY26)
9. Identify optimal PFAS treatment configuration for Mocho well field
10. Pump and treat the PFAS concentration with Stoneridge, COL and Mocho demineralization facility
11. Plan water supply operations to manage water supply needs
12. Continue developing the Chain-of-Lakes conveyance system concept

FY – Fiscal Year

Continuing Collaboration with DSRSD

1. Grant support
2. Information sharing
3. Transparency and engagement
4. Continue monitoring and data sharing
5. Exploring opportunities to collaborate on updating the potable reuse study as directed by the last Tri-Valley Liaison Committee

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Questions?
Acknowledgement:
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Lillian Xie, P.E.

Dublin San Ramon Services District
Water, wastewater, recycled water

PFAS in Wastewater

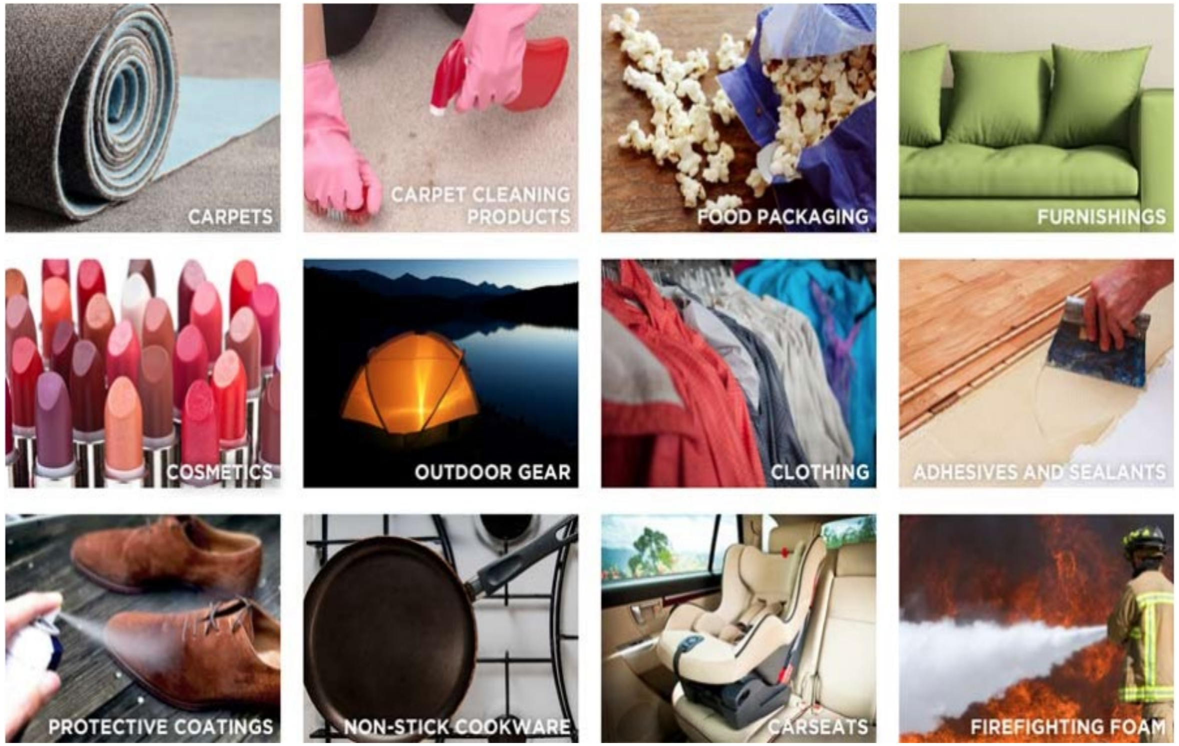
Board of Directors Meeting
March 18, 2025

Kristy Fournier, Laboratory and Environmental Compliance Manager

Discussion Topics

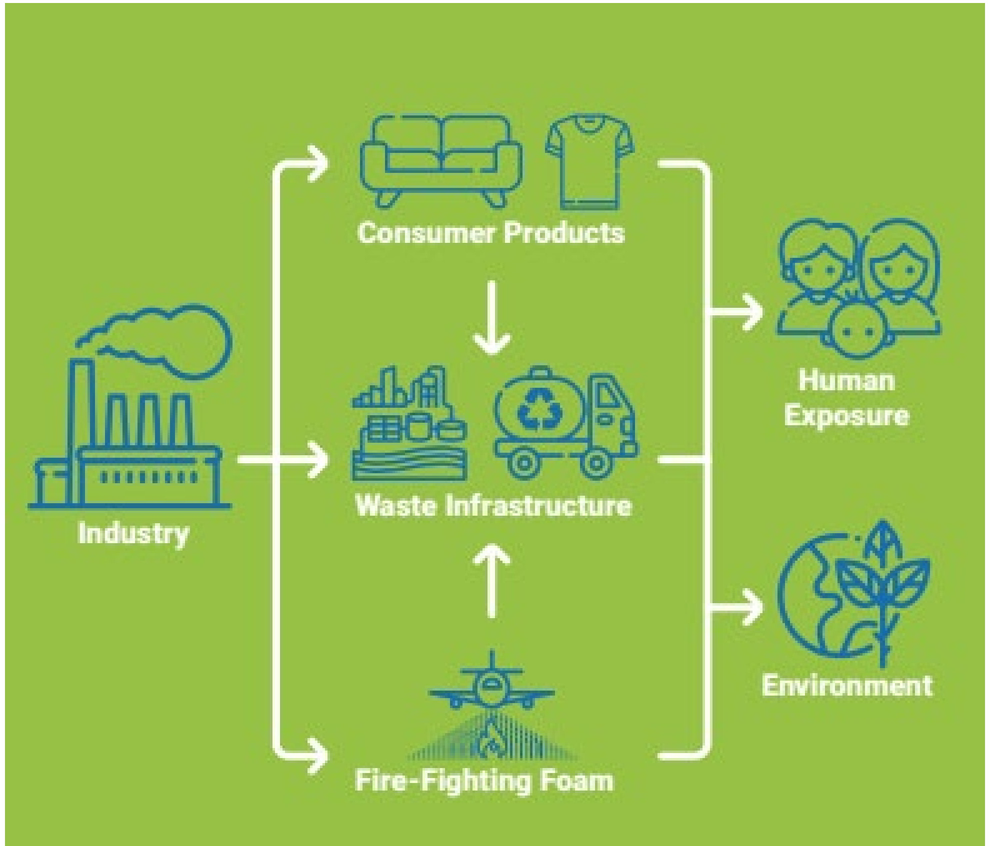
- Introduction
- DSRSD Wastewater Facilities
- San Francisco Bay Region PFAS Study
- Legislative Efforts
- Next Steps
- Final Takeaway

Where can you find PFAS?



Source: Green Sciences Policy Institute

Routes of Exposure

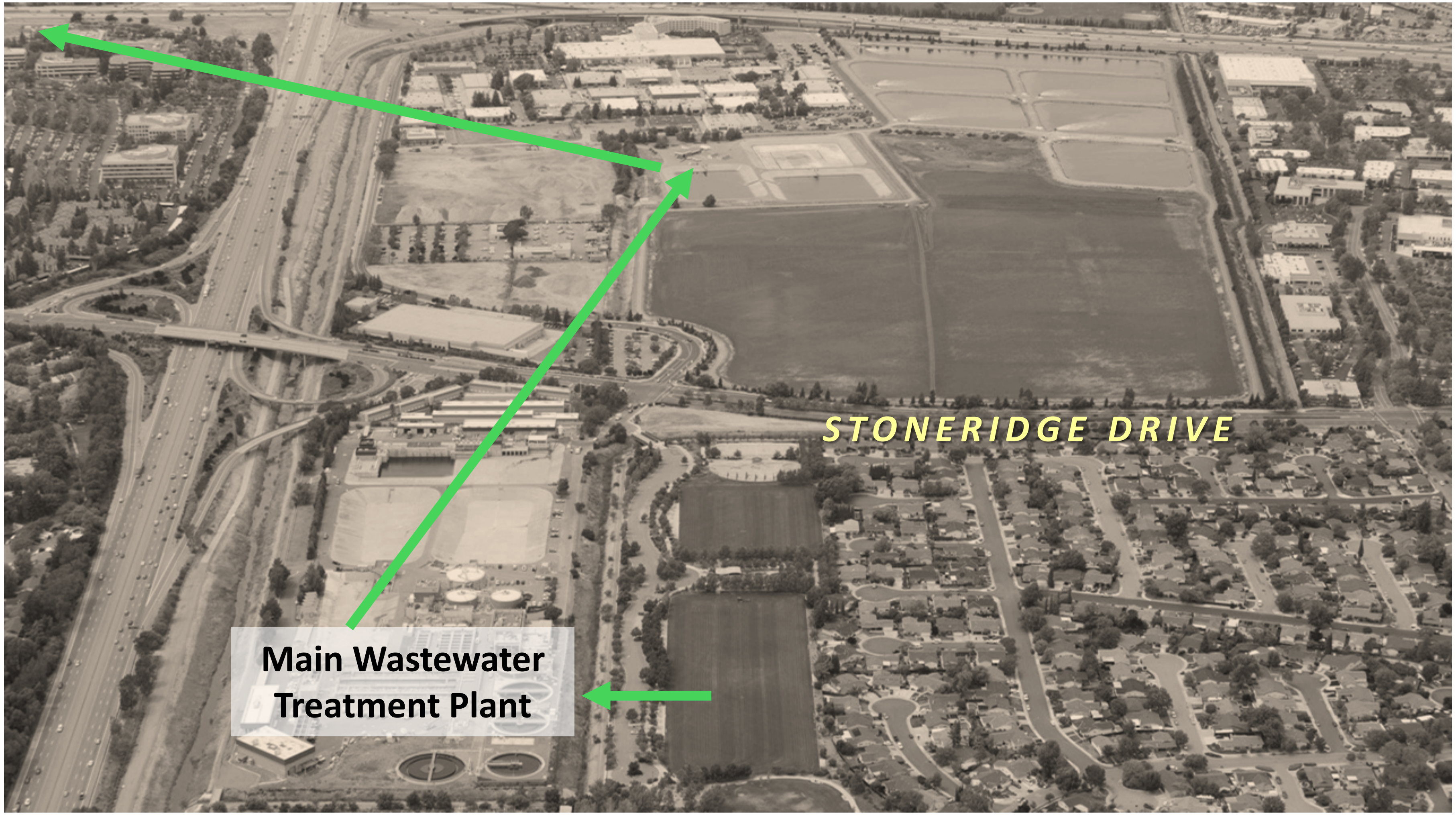


Source: CASA

DSRSD Wastewater Treatment Facilities

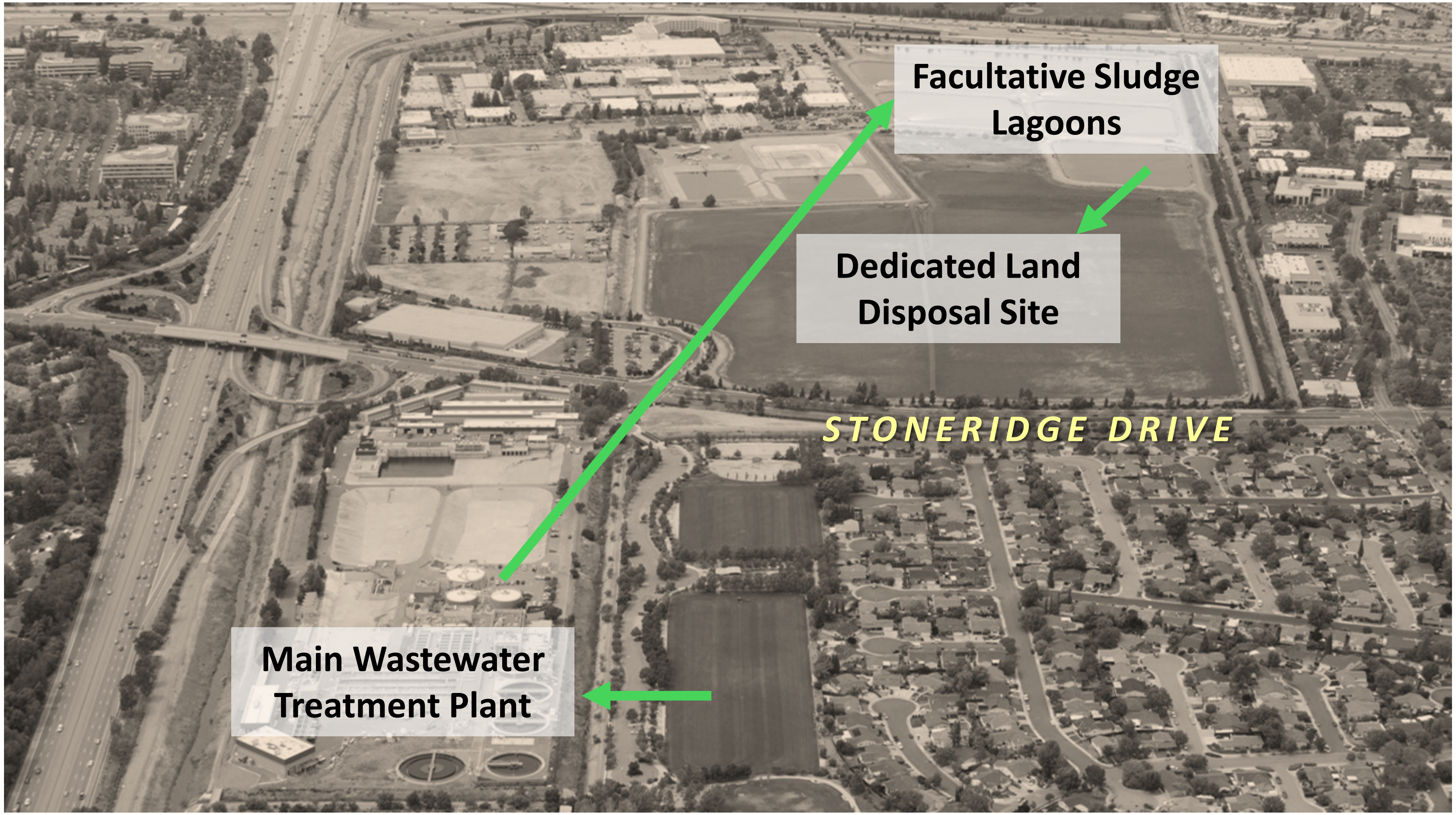
DSRSD Wastewater Treatment Facilities

DSRSD Wastewater Discharge Path



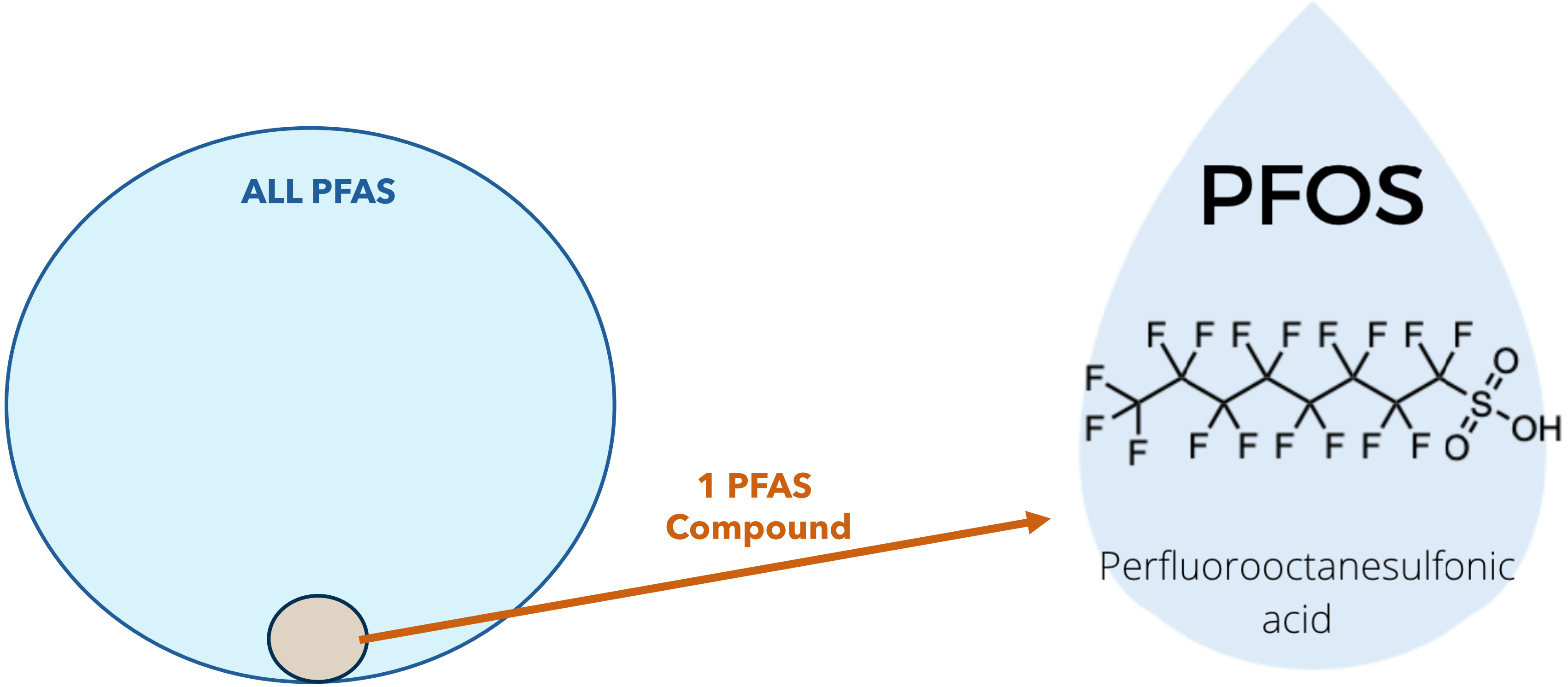
DSRSD Recycled Water Path

DSRSD Solids Path



San Francisco Bay Region PFAS Study

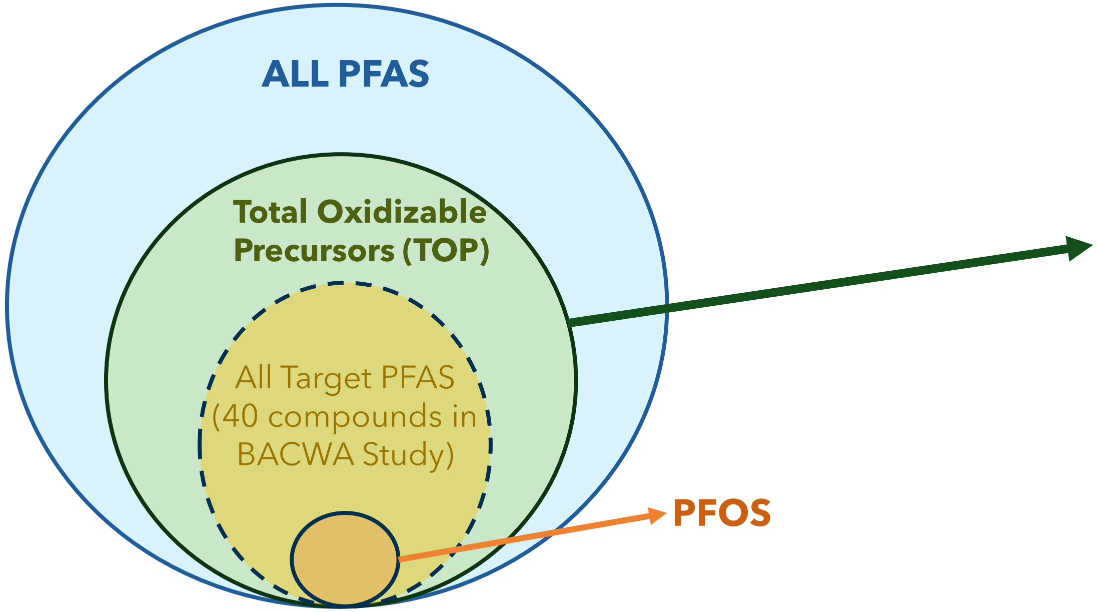
PFAS Class vs Compound



Note: Circles not drawn to scale

PFAS Analytical Methods

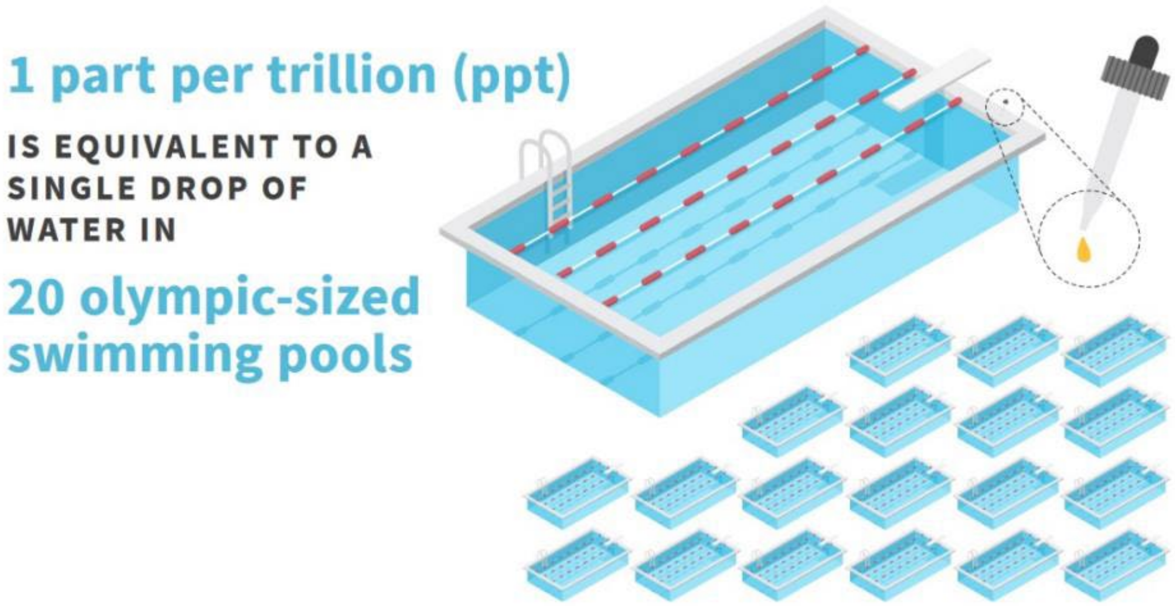
PFAS Methods



- TOP assay oxidizes the sample to convert PFAS to terminal transformation products then analyzed with the Target method.
- TOP gives a better estimate of all PFAS in a sample because it captures PFAS precursors

Note: Circles not drawn to scale Imagery based on BACWA Fact Sheet

Unit Measurement



- 1 mg/L (one part per million): 1 cup of water in a swimming pool
- 1 µg/L (one part per billion): 1 drop of water in a swimming pool
- 1ng/L (one part per trillion): 1 drop of water in 20 Olympic sized swimming pools

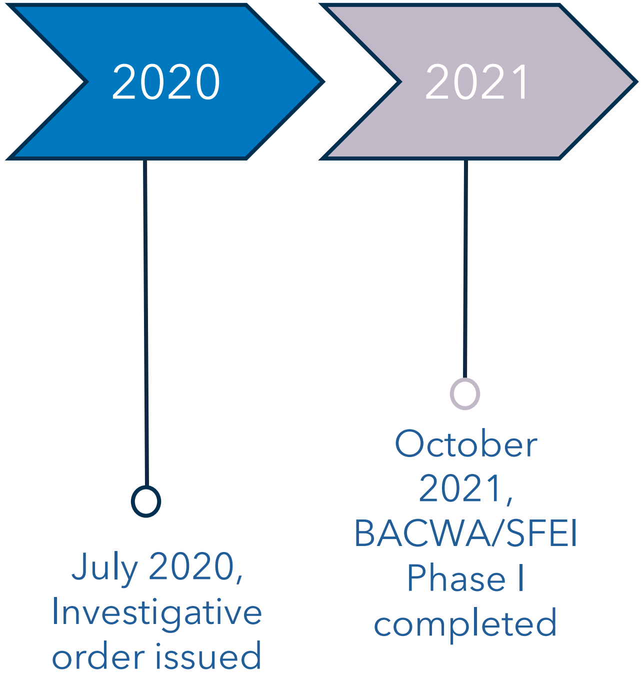
San Francisco Bay Region PFAS Study

- Multi-phase regional study being conducted by Bay Area Clean Water Agencies (BACWA) and San Francisco Estuary Institute

San Francisco Bay Region PFAS Study – Key Findings

- Using a broad-spectrum method like TOP shows that there is a significant level of PFAS precursors that would not have been captured in the targeted method
- Wastewater treatment plants are not creating nor destroying PFAS in their treatment processes
- The regional study found that residential wastewater is a major source of PFAS

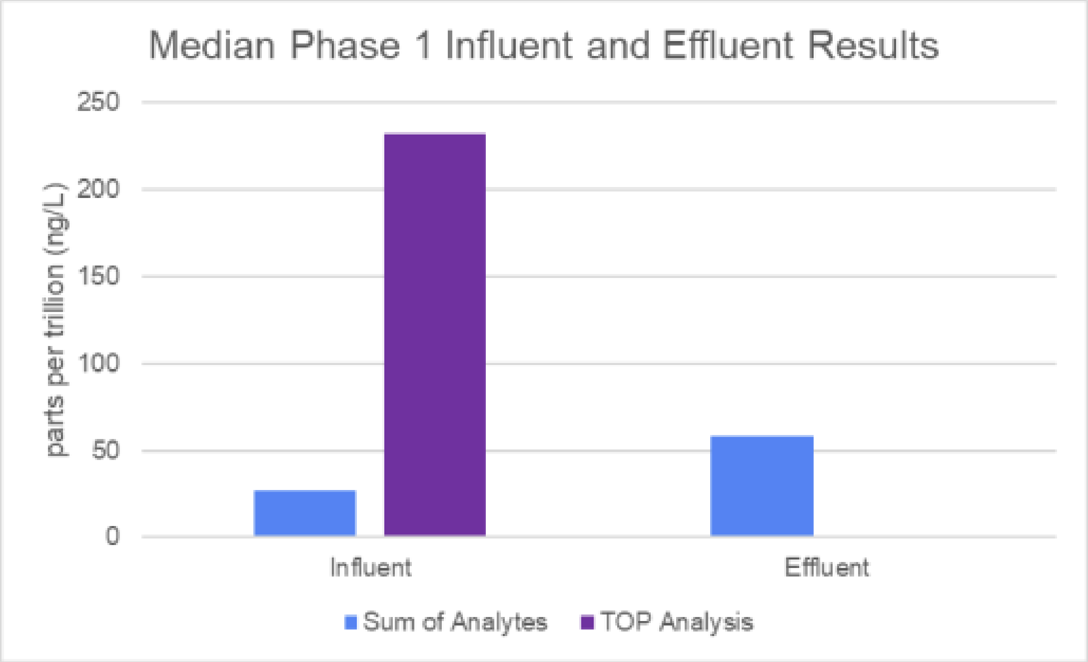
San Francisco Bay Region PFAS Study



- Phase 1: Monitor representative subset of facilities in Q4 2020
  - Study Focus: Fate and Transport of PFAS through the treatment process using two PFAS methods

San Francisco Bay Region PFAS Study

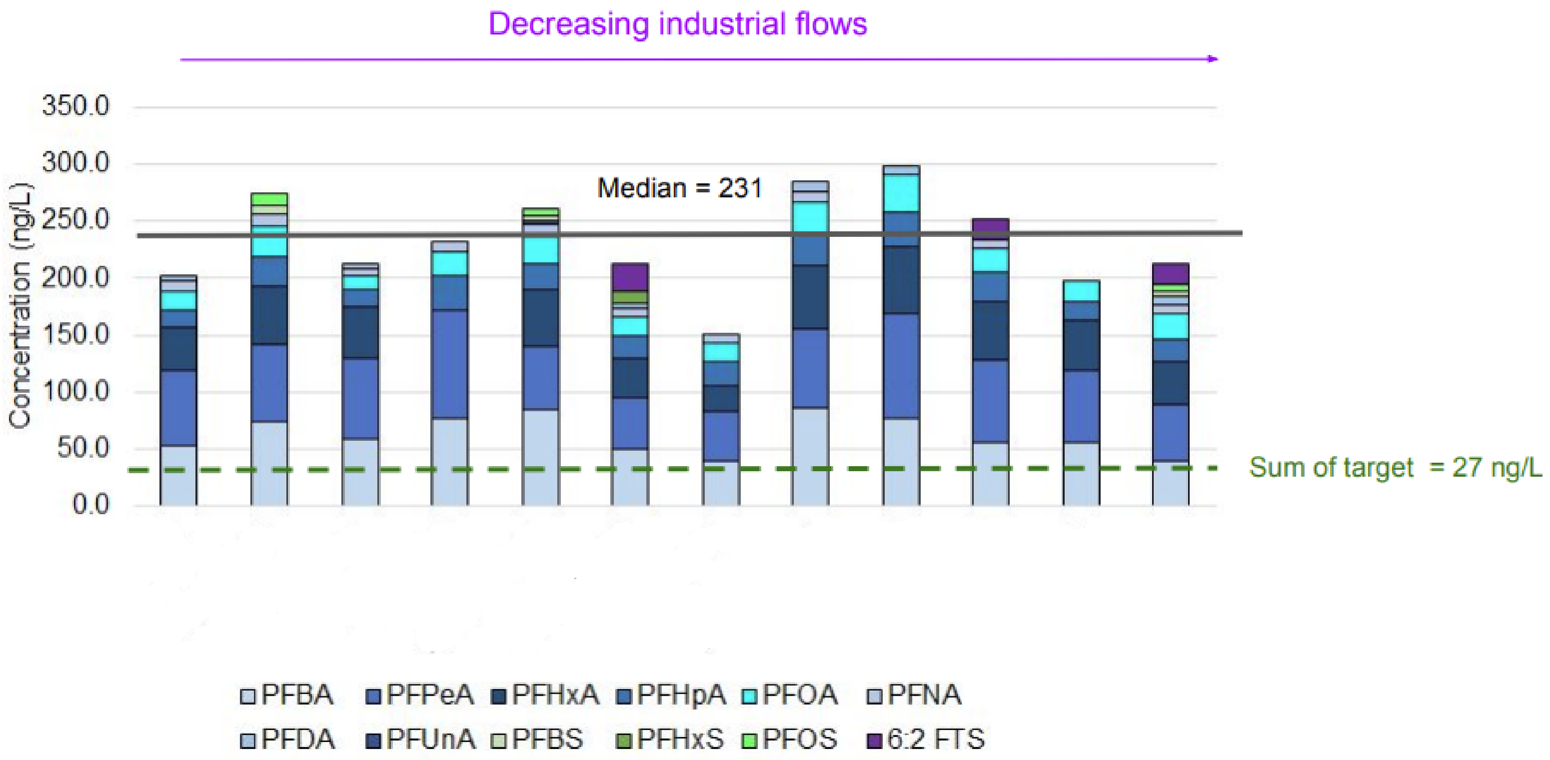
- Levels of PFAS detected were greater when using the TOP method than in the targeted method
- Influent levels had significant levels of PFAS precursors



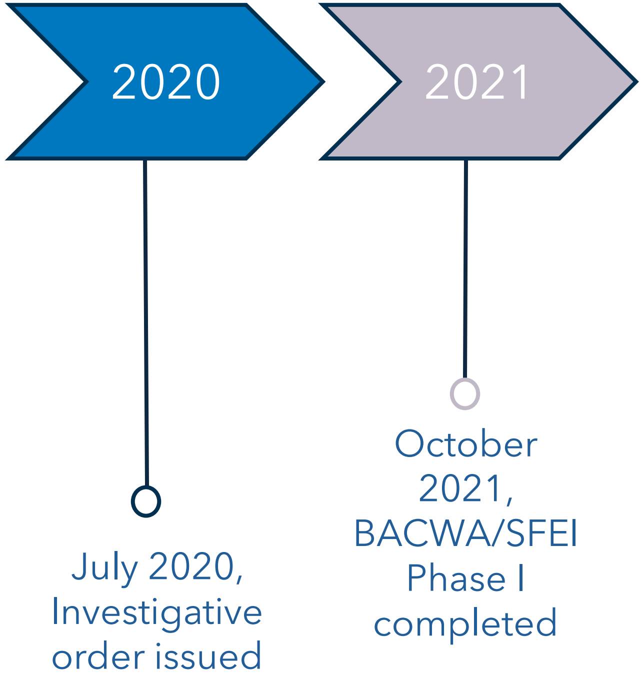
*Sum of analytes (PFAS)= Targeted method

San Francisco Bay Region PFAS Study

- Concentration of PFAS arriving at the wastewater treatment plant did not correspond with the industrial footprint of the agencies' service areas

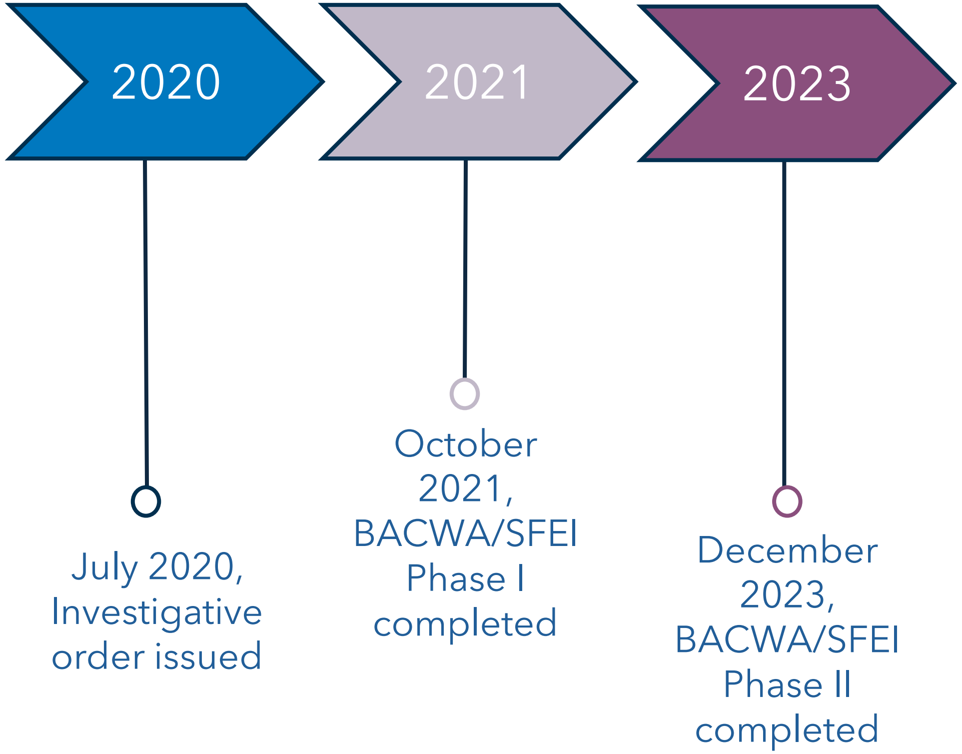


San Francisco Bay Region PFAS Study



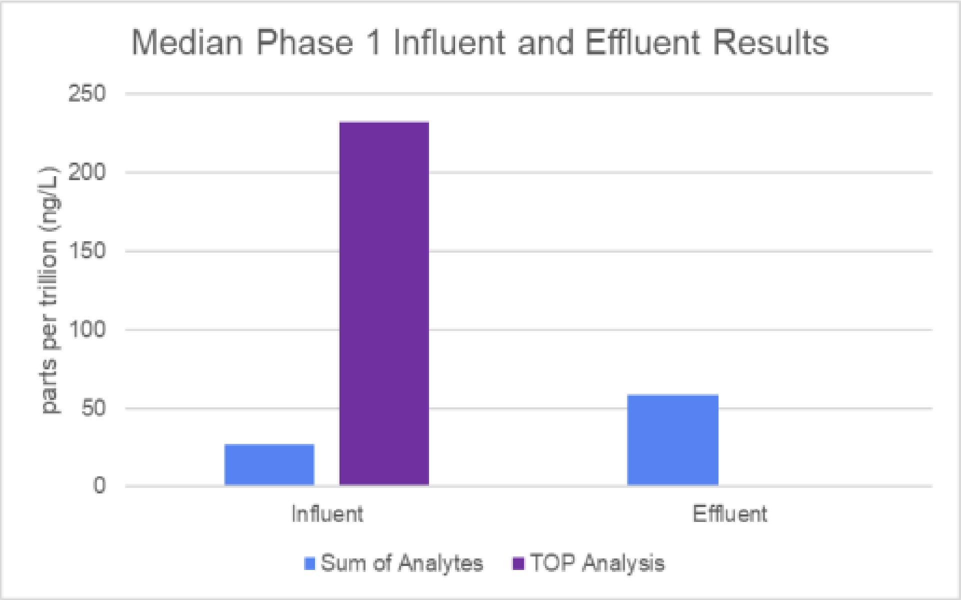
- Phase 1: Monitor representative subset of facilities in Q4 2020
  - Study Focus: Fate and Transport of PFAS through the treatment process
  - Takeaway:
    - Influent levels had significant levels of PFAS precursors
    - Bay Area Agencies had similar PFAS levels and profiles
  - Next Steps
    - Fate and transport of PFAS using TOP analysis
    - Sewershed sampling

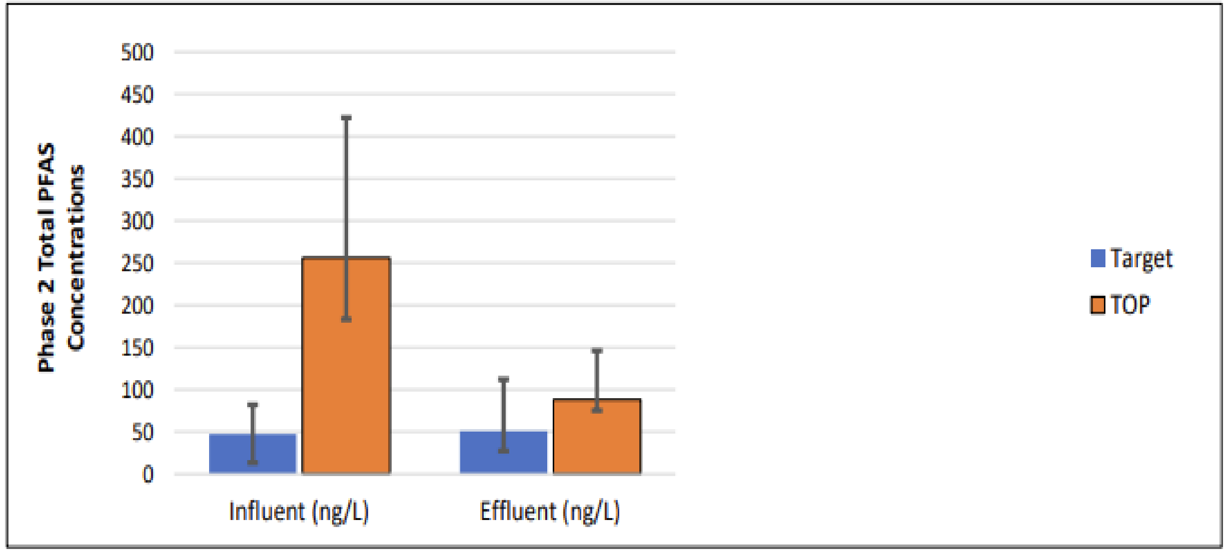
San Francisco Bay Region PFAS Study



- Phase 2: Additional Monitoring
  - Study Focus:
    - Fate and Transport of PFAS through the treatment process using TOP analysis
    - Sewershed sampling
    - Groundwater sampling

San Francisco Bay Region PFAS Study

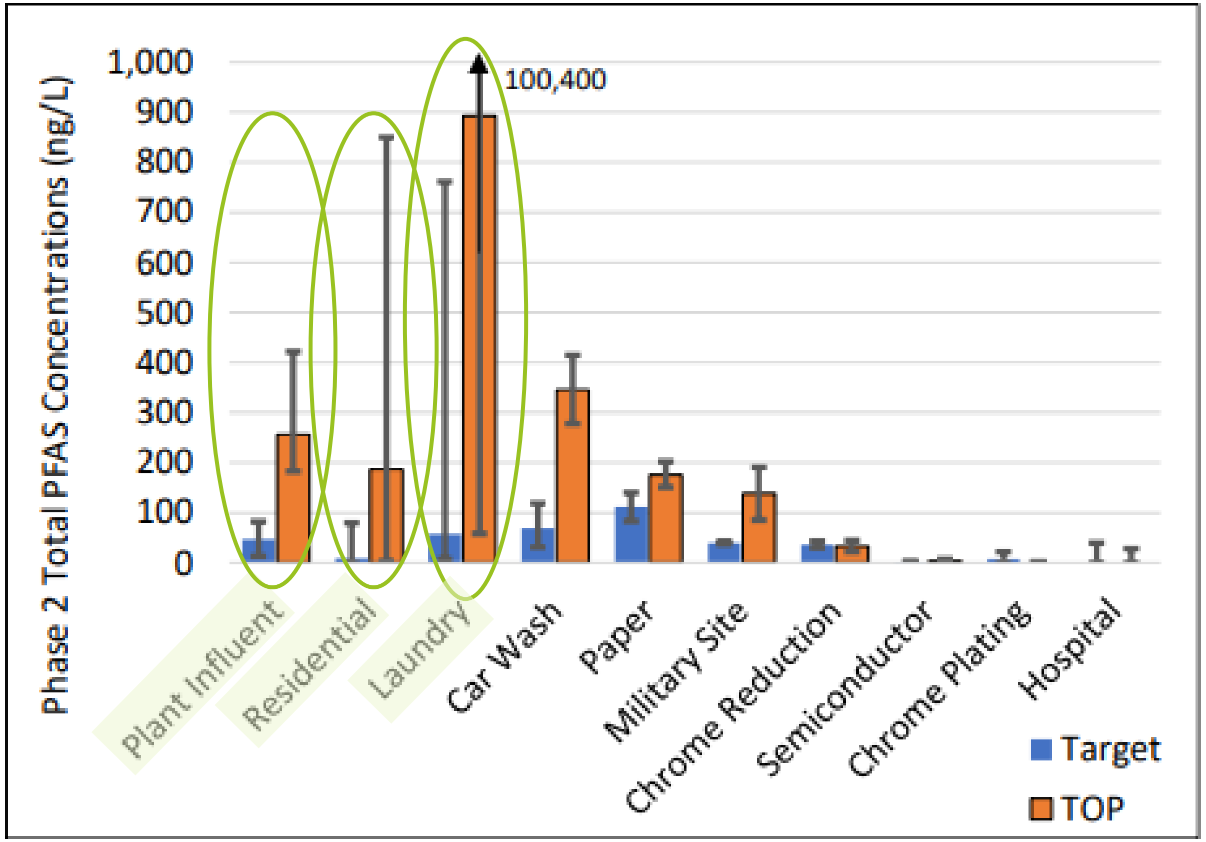




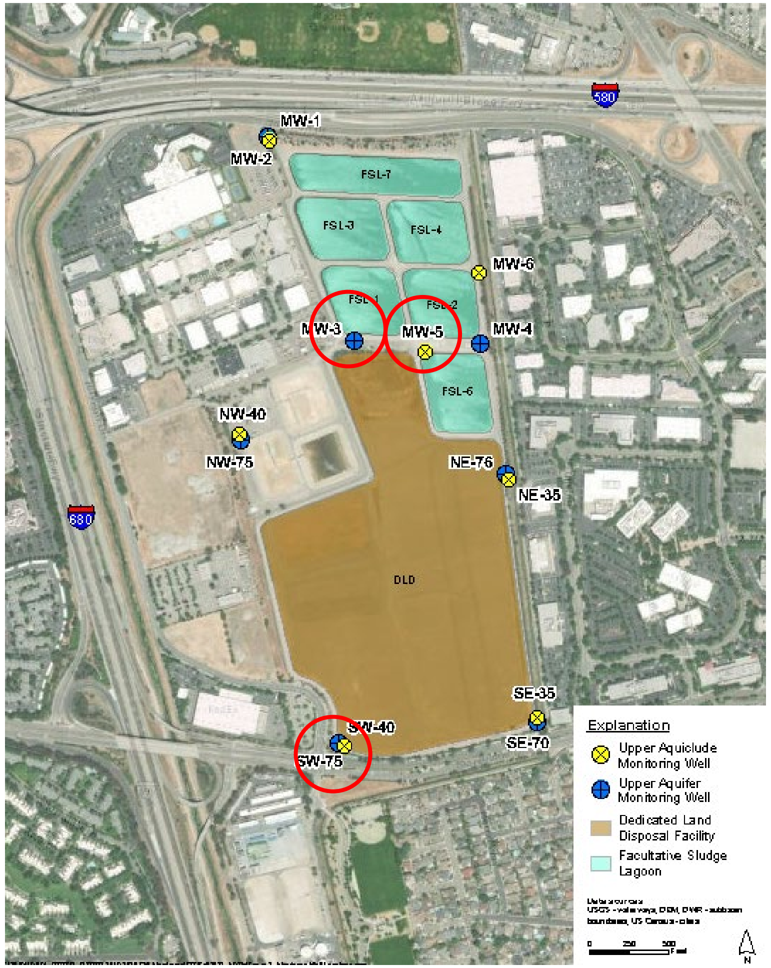
*Sum of analytes= Targeted method

San Francisco Bay Region PFAS Study

- Some industrial laundries had PFAS measured concentrations that were higher than the median plant influent
- Residential PFAS concentrations were slightly below plant influent
- Residential and commercial flow accounts for 95% of most Bay Area agencies influent flow



San Francisco Bay Region PFAS Study



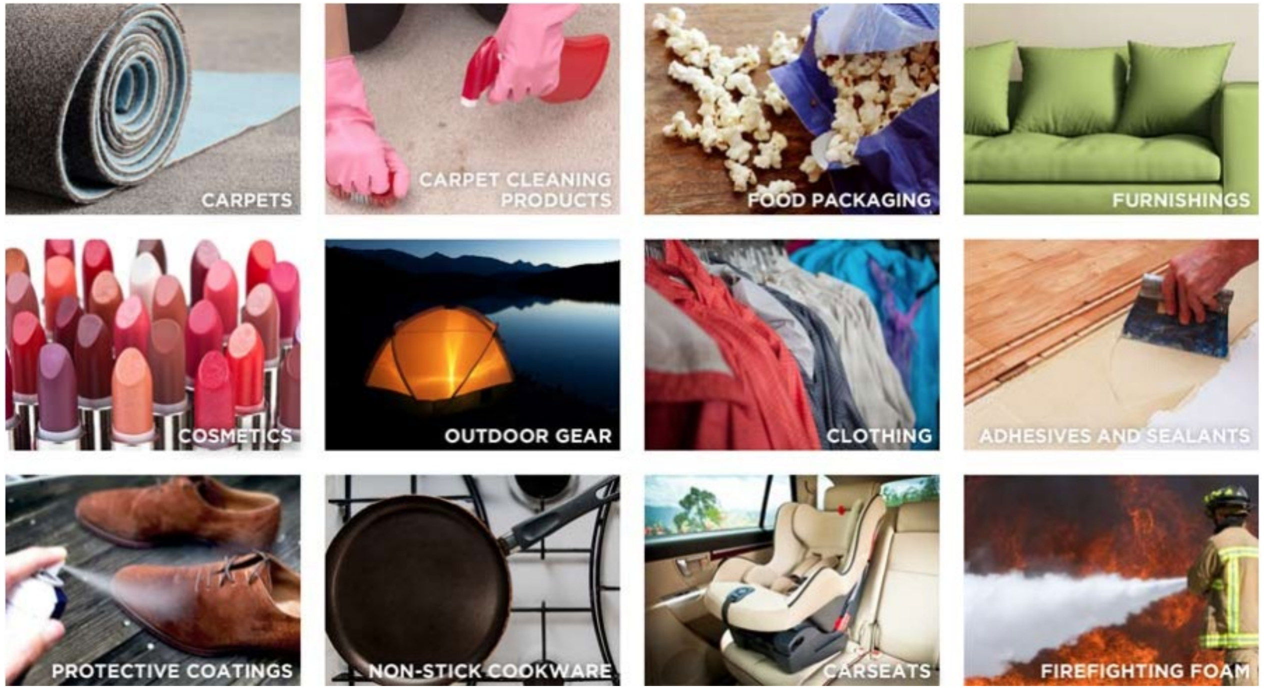
- 3 wells were sampled for PFAS
- PFAS were detected in 2 of the three wells

San Francisco Bay Region PFAS Study

- 2020 — July 2020, Investigative order issued
- 2021 — October 2021, BACWA/SFEI Phase I completed
- 2023 — December 2023, BACWA/SFEI Phase II completed

- Phase 2: Additional Monitoring
  - Study Focus:
    - Fate and Transport of PFAS through the treatment process using TOP analysis
    - Sewershed sampling
  - Takeaway:
    - Wastewater treatment plant were not creating nor destroying PFAS in their treatment processes
    - Residential wastewater is a major source of PFAS
  - Next Steps
    - Phase 3 will start in 2026
      - Focus on consumer products with the highest PFAS contribution where legislation is not yet in place
    - DSRSD Study

PFAS Concentration in Consumer Products



Source: Green Sciences Policy Institute

- Concentrations measured in the mg/L (ppm) are equivalent to 1,000,000 x ng/L (ppt)

CA Legislative Efforts

- Limiting the flow of PFAS in consumer products
  - Legislation that has passed into law
    - Food packaging- AB 1200- effective January 2023
    - Juvenile Products- AB 652 – effective July 2023
    - Cosmetic products- AB 2771 – effective January 2025
    - Textile Articles- AB 1817 – effective January 2025
  - Legislation that has been introduced
    - Prohibits the sale of products where PFAS is intentionally added
      - SB 682 by Senator Allen- Introduced February 2025

Next Steps

- Continue to participate in PFAS wastewater studies with regional and state partners
- Continue to be compliant with all regulations
- Continue to monitor and advocate for PFAS legislation to remove PFAS from consumer products

Key Takeaway

For as long as PFAS continues to be produced and used in consumer products, PFAS will be present in wastewater.

Dublin San Ramon Services District
Water, wastewater, recycled water

Questions?

DSRSD PFAS and Regional Hydrogeologic Study

DSRSD Board Meeting
March 18, 2025

LSCE

Discussion Topics

- Introduction
- Study Overview and Findings
  - Hydrogeologic Conceptual Model (HCM)
  - Groundwater Water Quality
  - Groundwater Flow Model Results
  - Recycled Water Analysis
- Questions

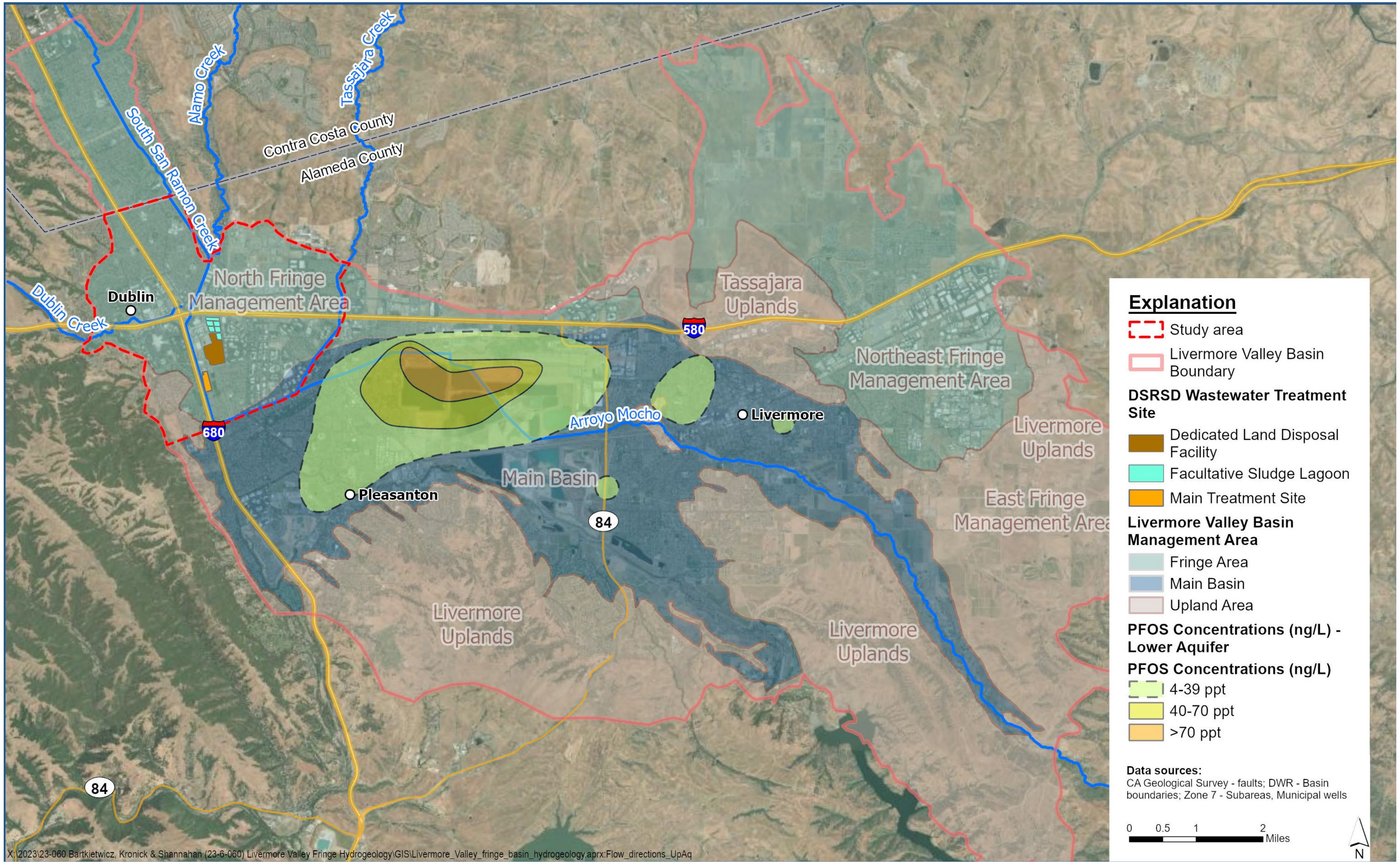
LSCE

Introduction

- In 2023, DSRSD contracted with LSCE to study the potential for wastewater treatment plant operations to contribute to the presence of PFAS detected in the Livermore Amador Groundwater Basin (Main Basin)
- Key objectives:
  - Analyze the potential for PFAS detected at the Dedicated Land Disposal Facility to migrate off-site
  - Evaluate areas of recycled water application compared to the known PFOS footprint in the Main Basin
- PFOS is one of many PFAS constituents and used here as an indicator for presence of PFAS

LSCE

Introduction



LSCE

Key Takeaways

- DSRSD facilities located two miles west and downgradient of Main Basin PFOS footprint; indicating the PFOS footprint is moving generally towards DSRSD facilities and DSRSD facilities are not contributing to main PFOS footprint
- DSRSD facilities and surrounding area underlain by 40 to 50 feet of surficial very low permeability clay (sometimes referred to as an aquiclude)
- Typical groundwater travel times to surface water or off-site locations are decades to centuries
- Detection of PFOS at DSRSD facilities limited to a very small and shallow area
- Available evidence indicate no current and minimal potential for future impacts to municipal groundwater sources in Main Basin from DSRSD Facilities and potential PFOS contribution to surface water from DSRSD Facilities is negligible

Key Takeaways

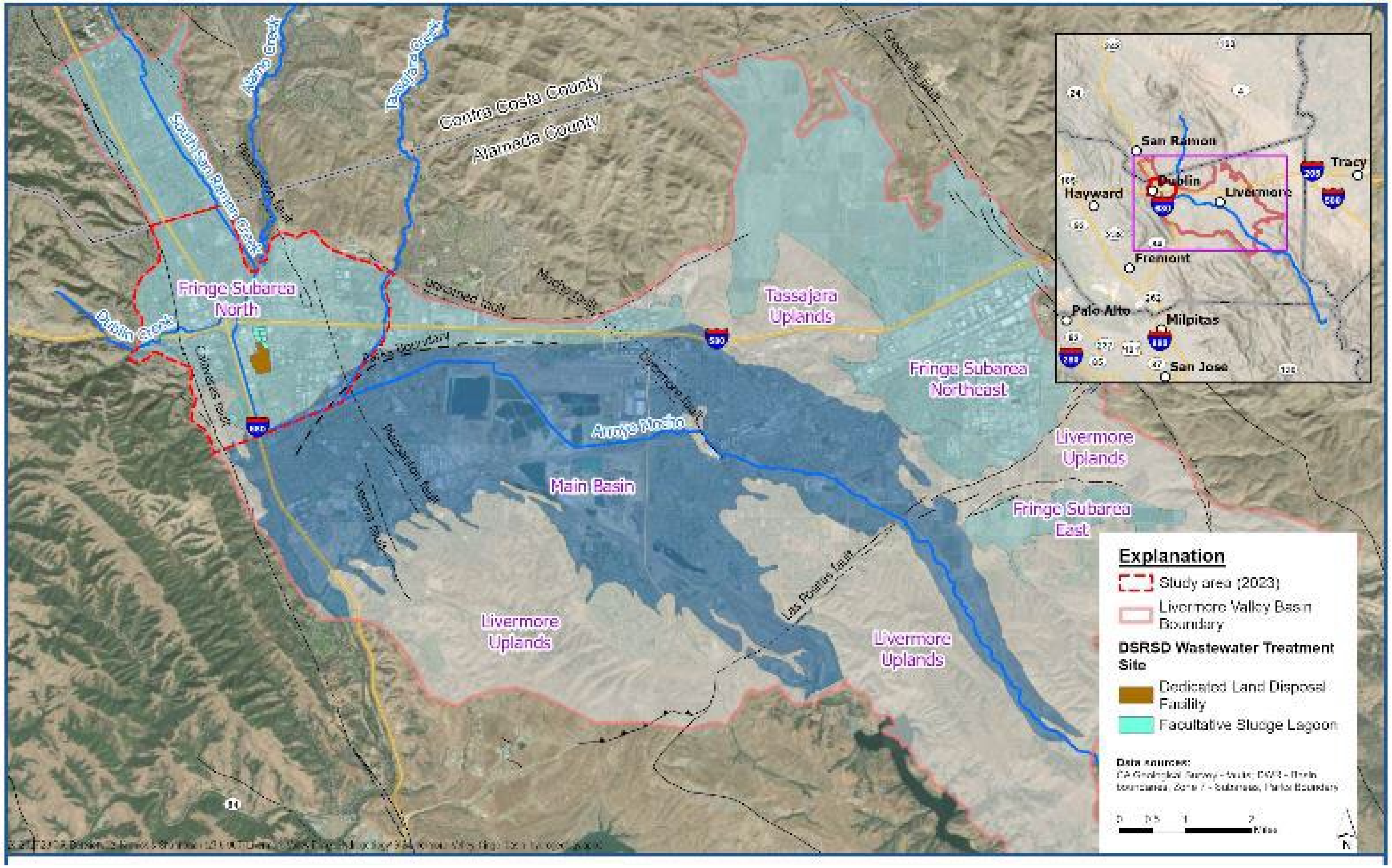
- Overlay of parcels irrigated with recycled water with PFOS footprint suggests no contribution to PFOS footprint
- Presence of surficial clay layer throughout area of recycled water application restricts potential movement

LSCE

STUDY OVERVIEW AND FINDINGS

Hydrogeologic Conceptual Model

HCM - Study Area



Approximate boundaries:

West & northeast - Basin boundaries

North - County line

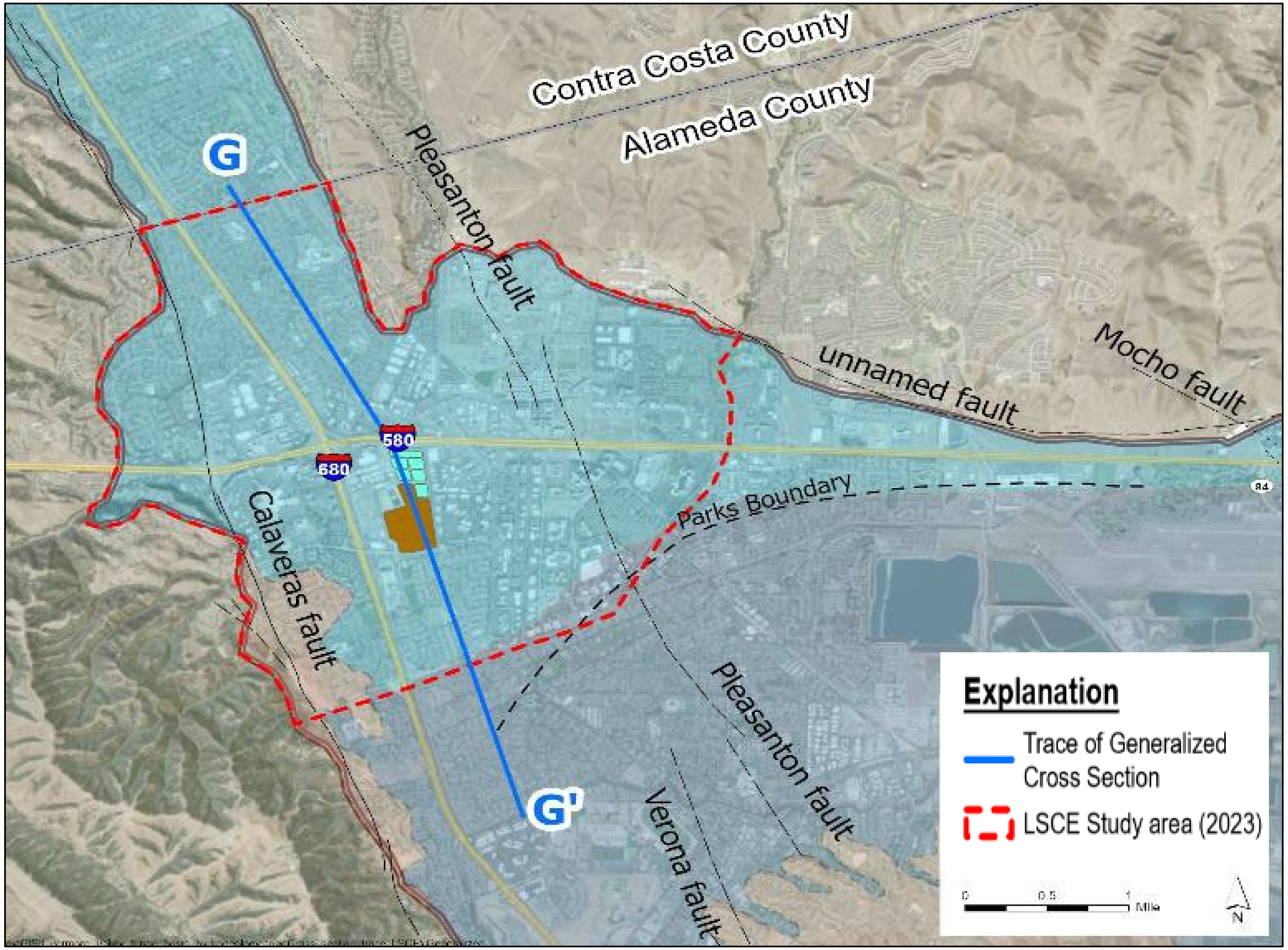
East - Tassajara Creek

Area:

9.3 square miles (5,940 acres)

LSCE

HCM - Generalized Geologic Cross Section



LSCE

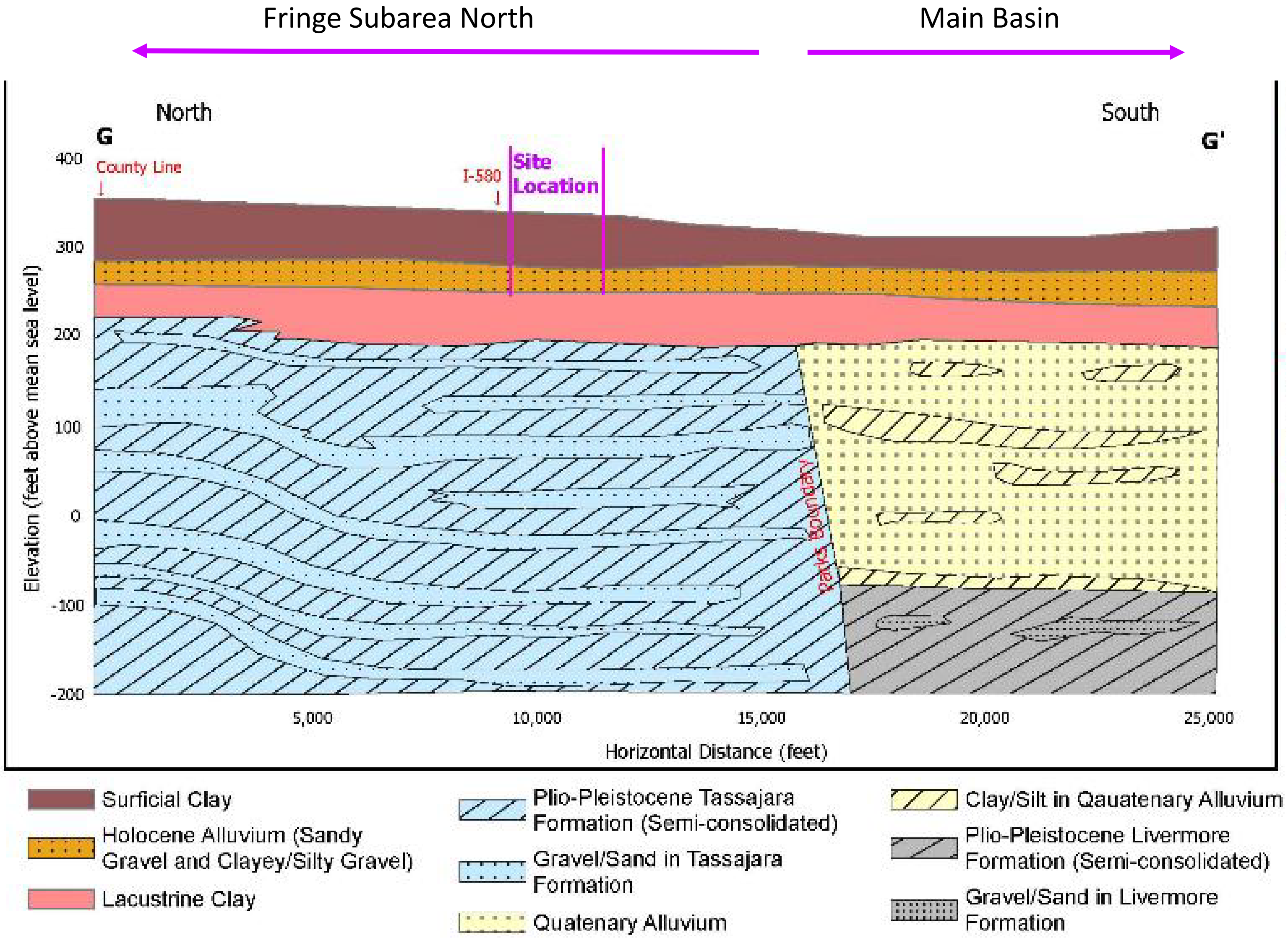
HCM - Generalized Geologic Cross Section

<u>Lithology in the Fringe Subarea North</u>

- Surficial clay (Aquiclude): 10 to >50 ft thick
- Holocene alluvium: 20 to 70 ft thick (Upper Aquifer)
- Lacustrine clay (Aquitard): 30 to 50 ft thick
- Pleistocene to Pliocene Tassajara Formation: thickness up to 4000 ft

Surficial Clay, Upper Aquifer and Aquitard extend into the Main Basin.

Quaternary Alluvium forms the "Lower Aquifer" in the Main Basin



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HCM - Site Geologic Cross Section

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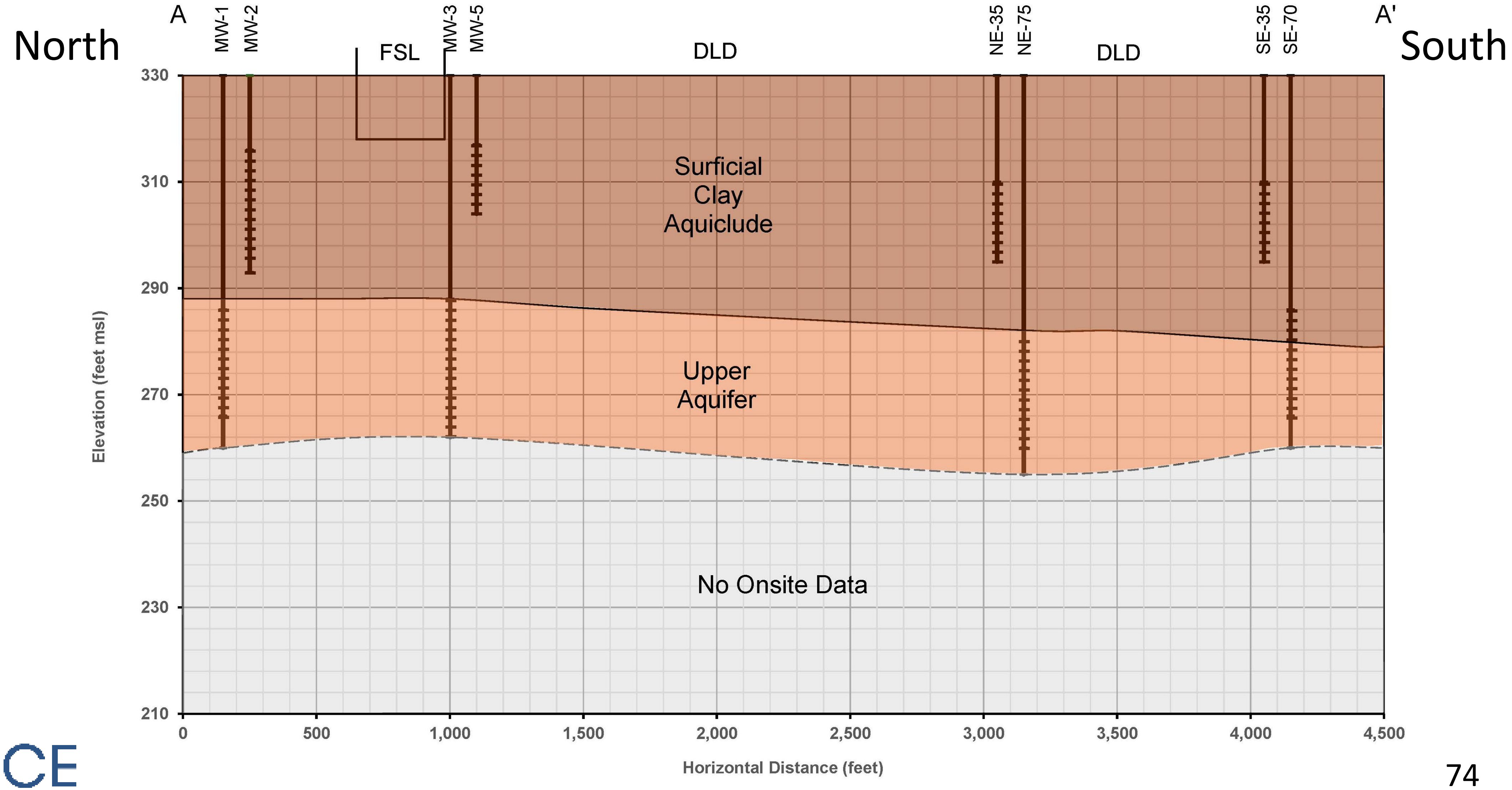
HCM - Site Geologic Cross Section



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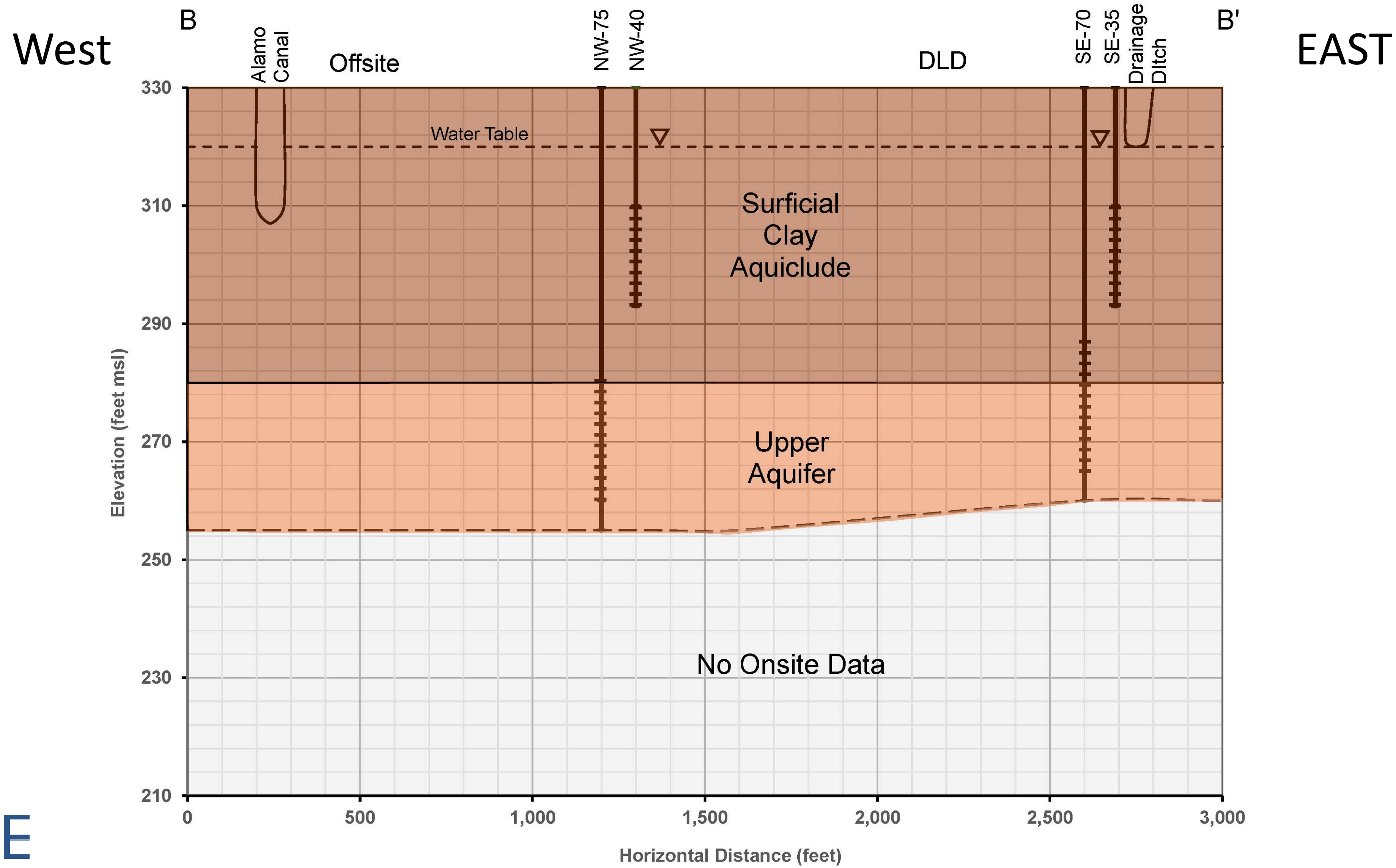
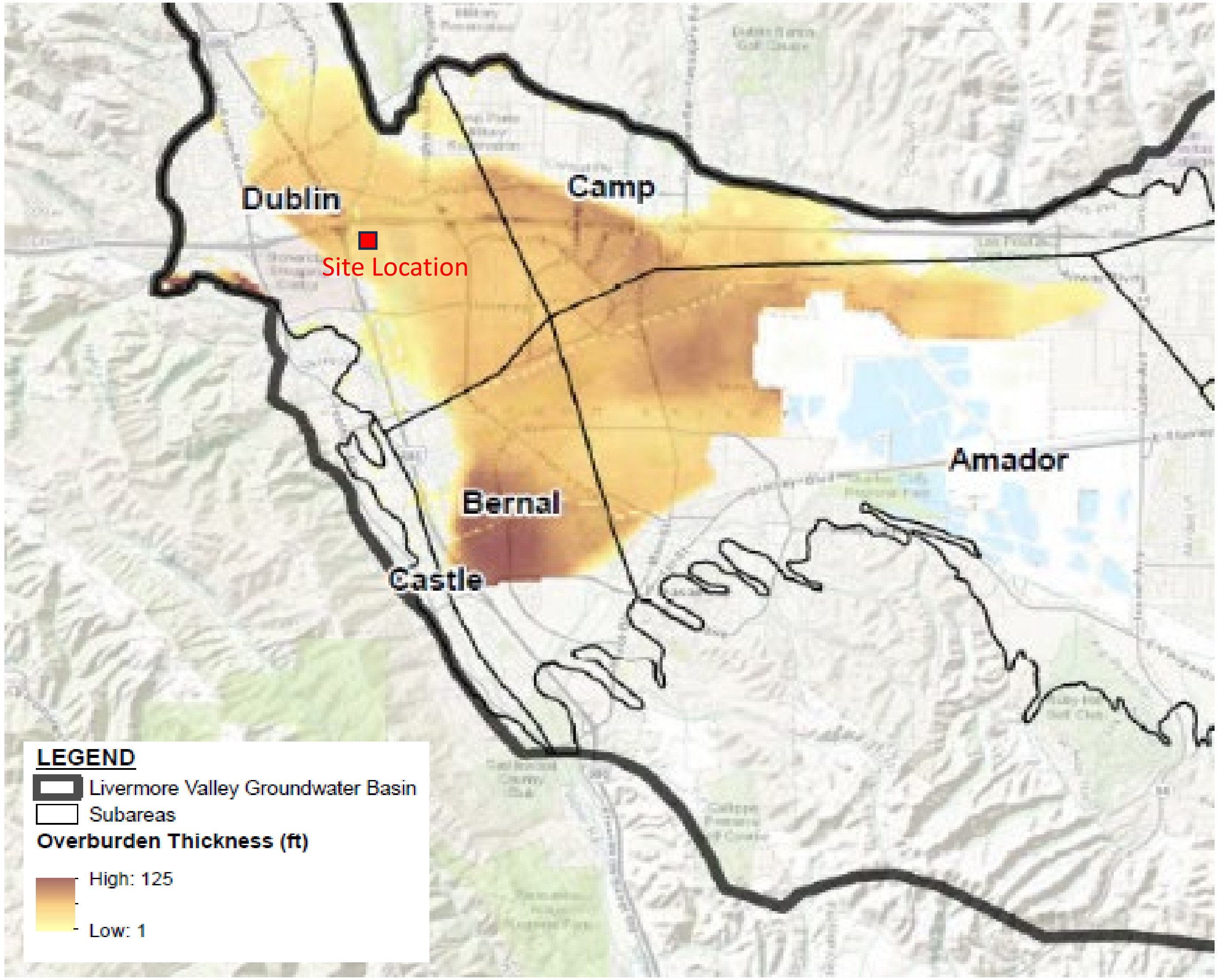
HCM - Site Geologic Cross Section



LSCE

HCM – Extent and Thickness of Surficial Clay



Overburden thickness (Zone 7, 2021)

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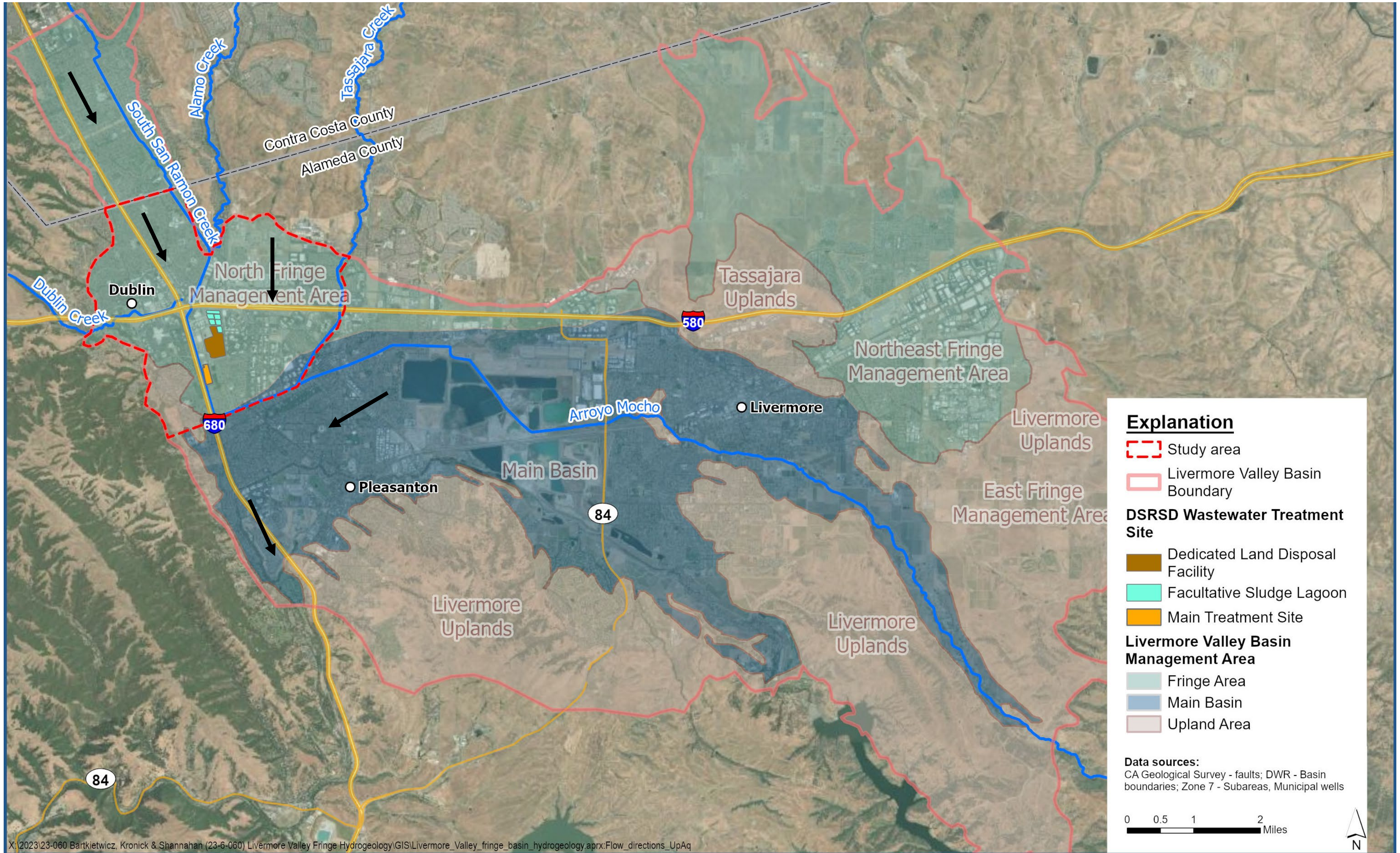
HCM - Groundwater Flow Directions: Upper Aquifer



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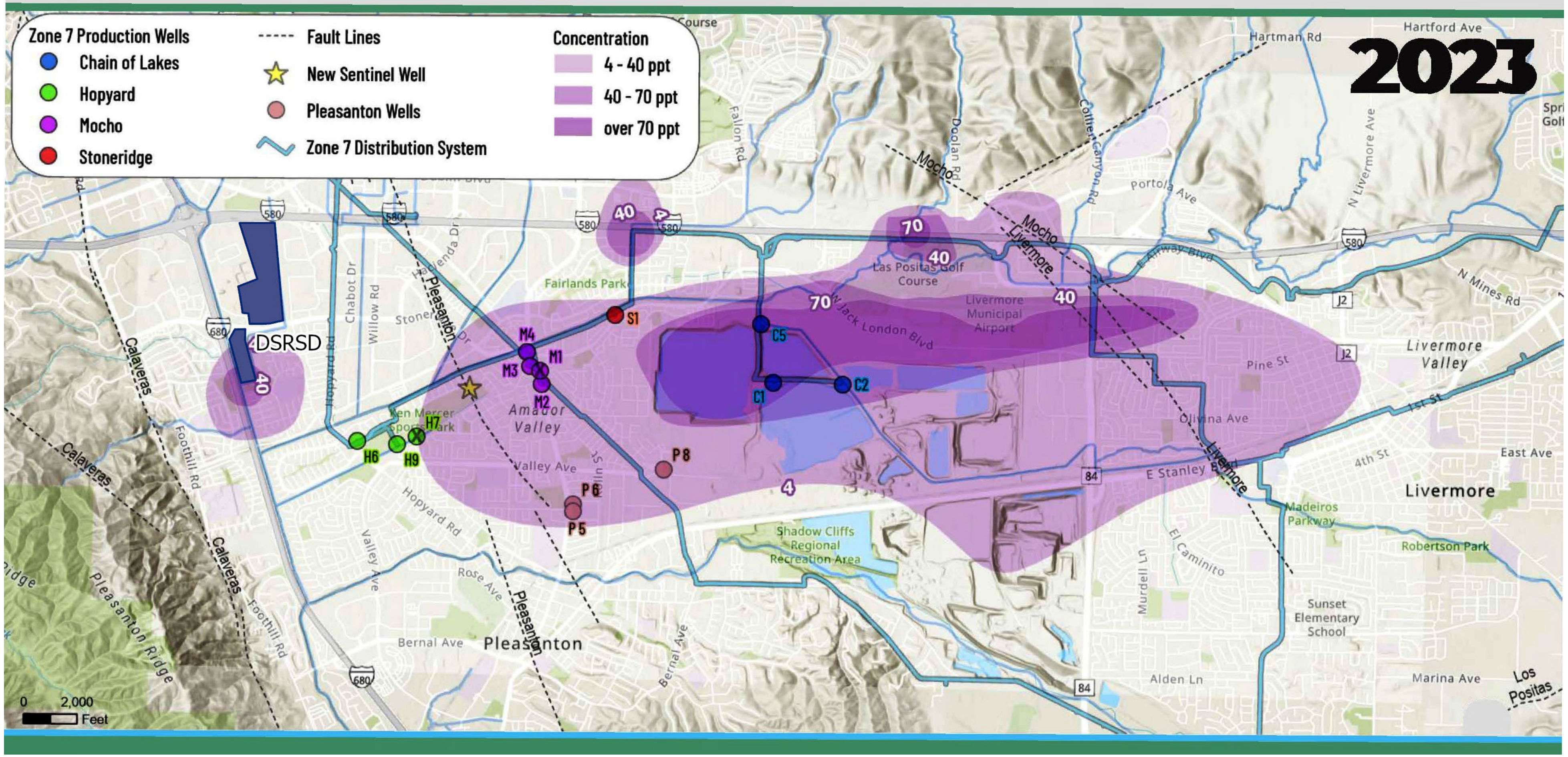
Groundwater Quality

Groundwater Quality – Zone 7 PFOS Mapping

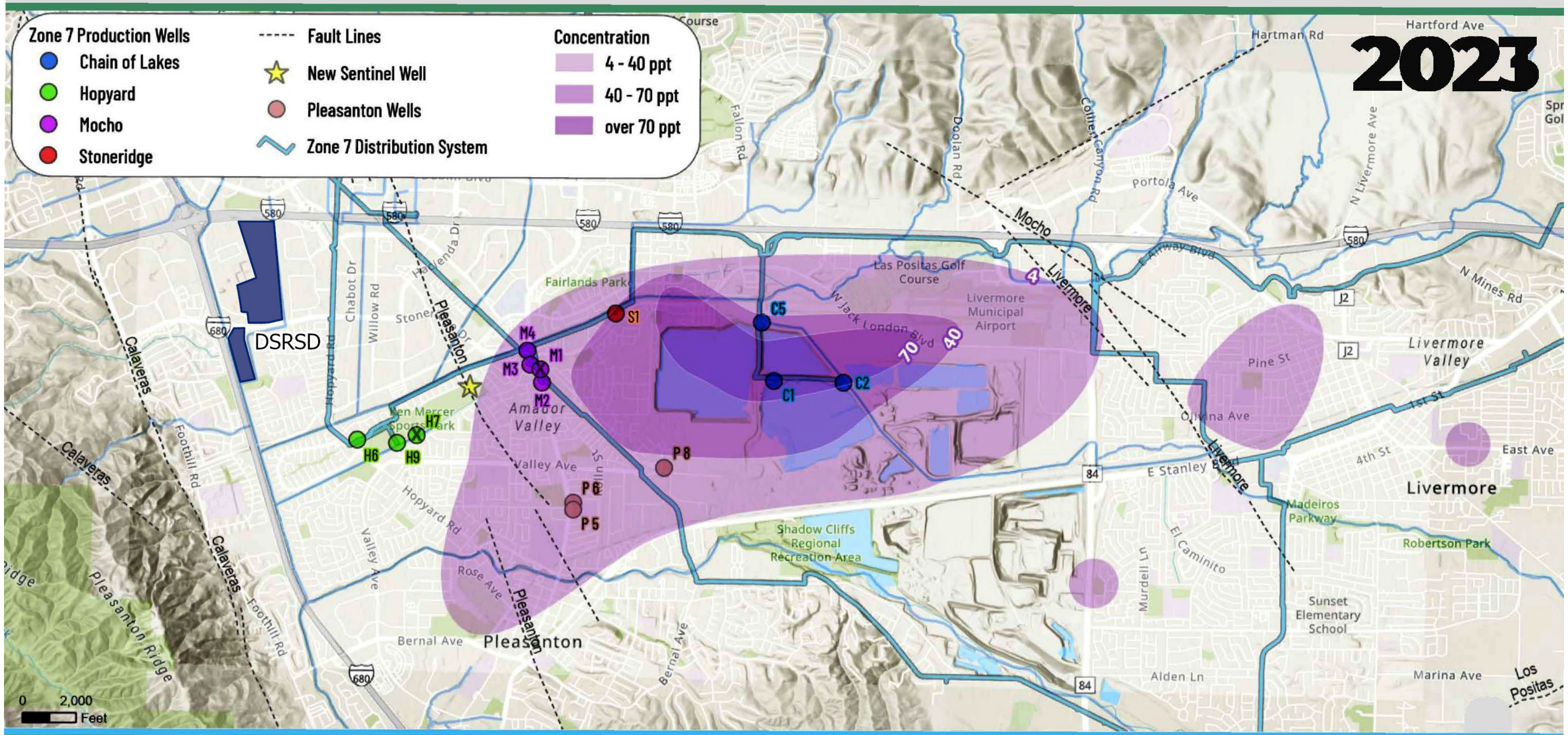
Upper Aquifer PFOS Footprints (2021 and 2023)



Results of May 2022 and November 2023 on-site samples are not included

Groundwater Quality – Zone 7 PFOS Mapping

Lower Aquifer PFOS Footprints (2021 and 2023)



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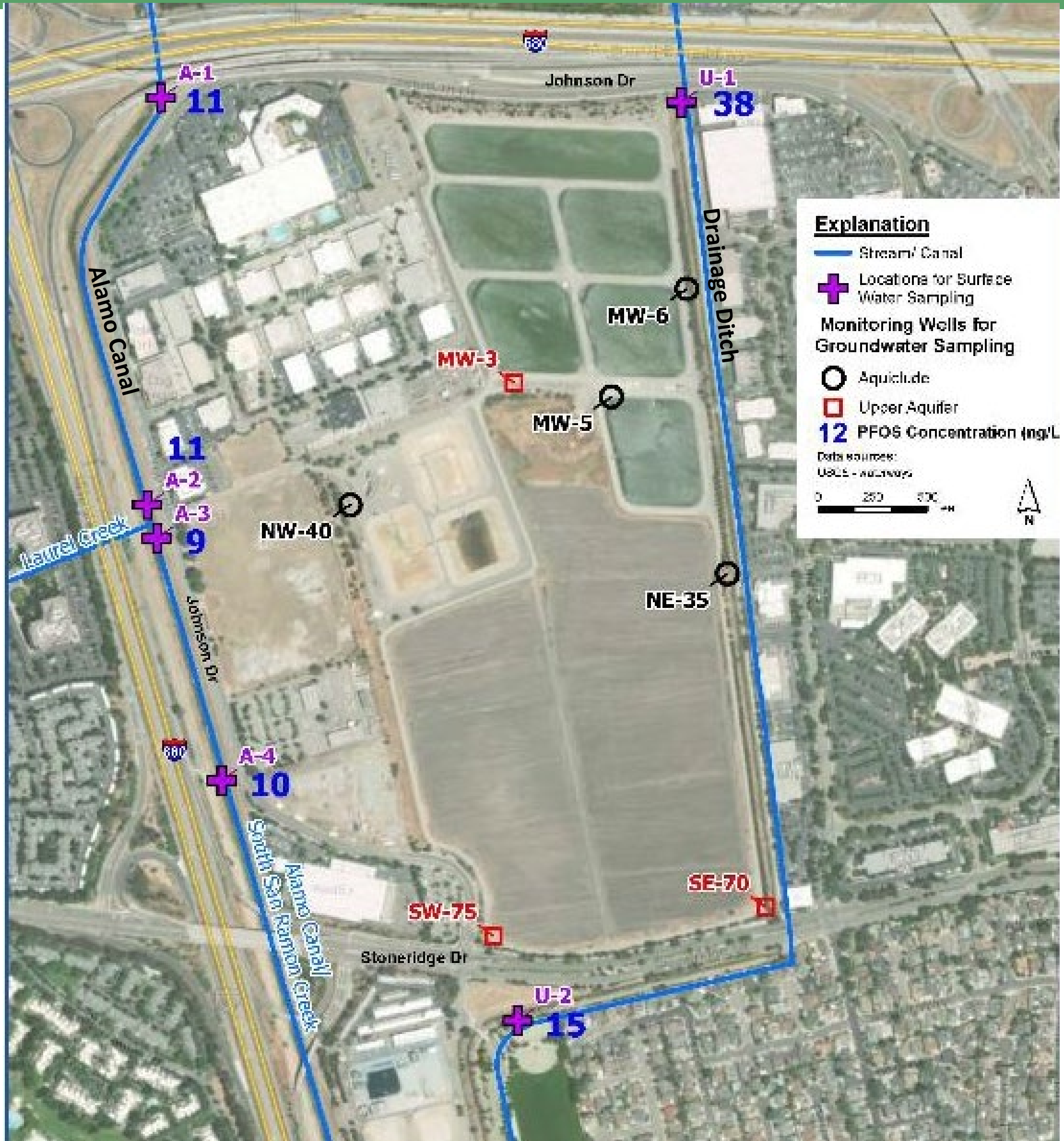
On-site PFOS Detection in November 2023 Surface Water Samples

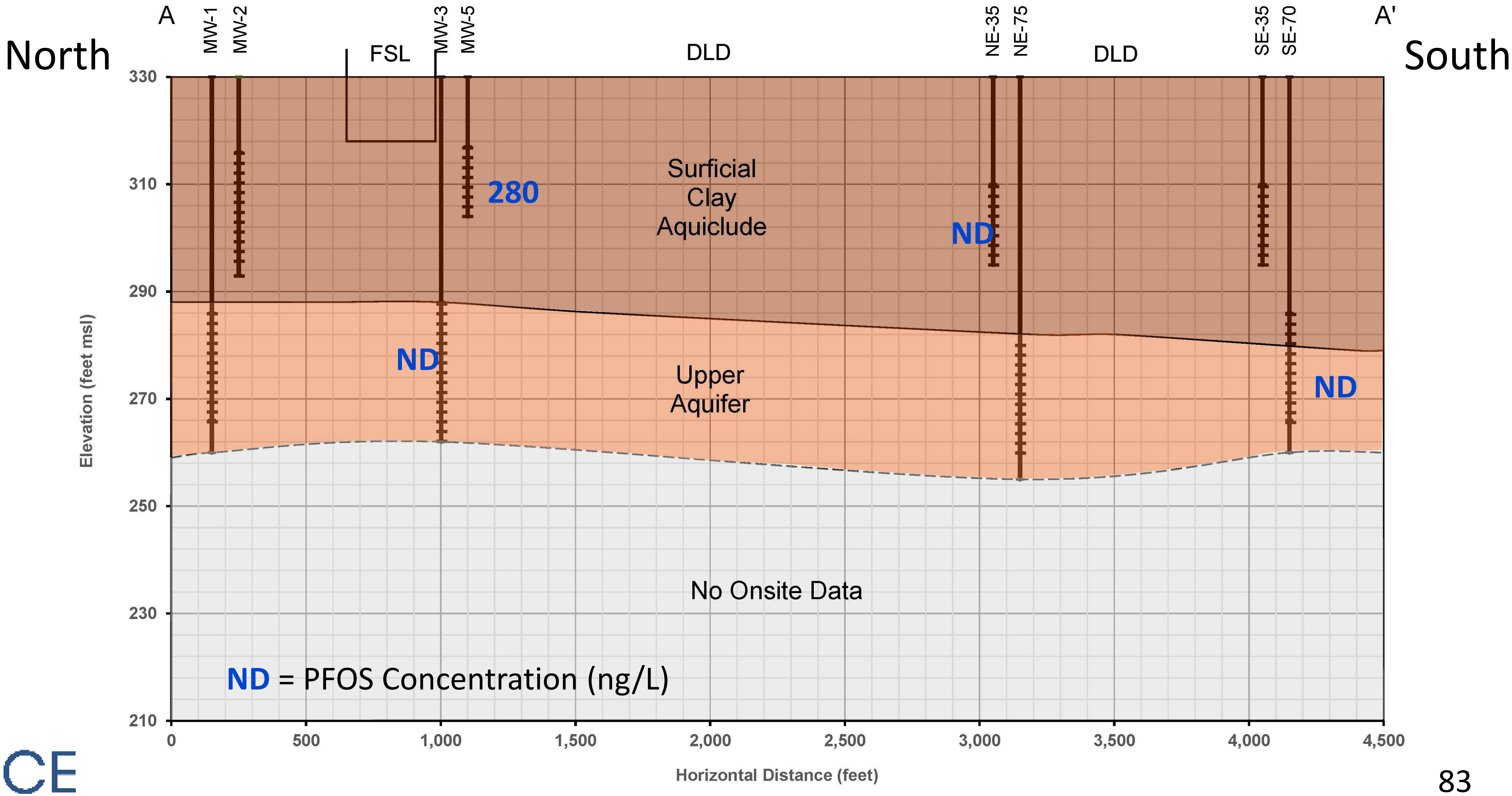


LSCE

On-site PFOS Detection in November 2023 Groundwater Samples

LSCE

Ground Water Quality - Site Geologic Cross Section



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Groundwater Flow Model Results

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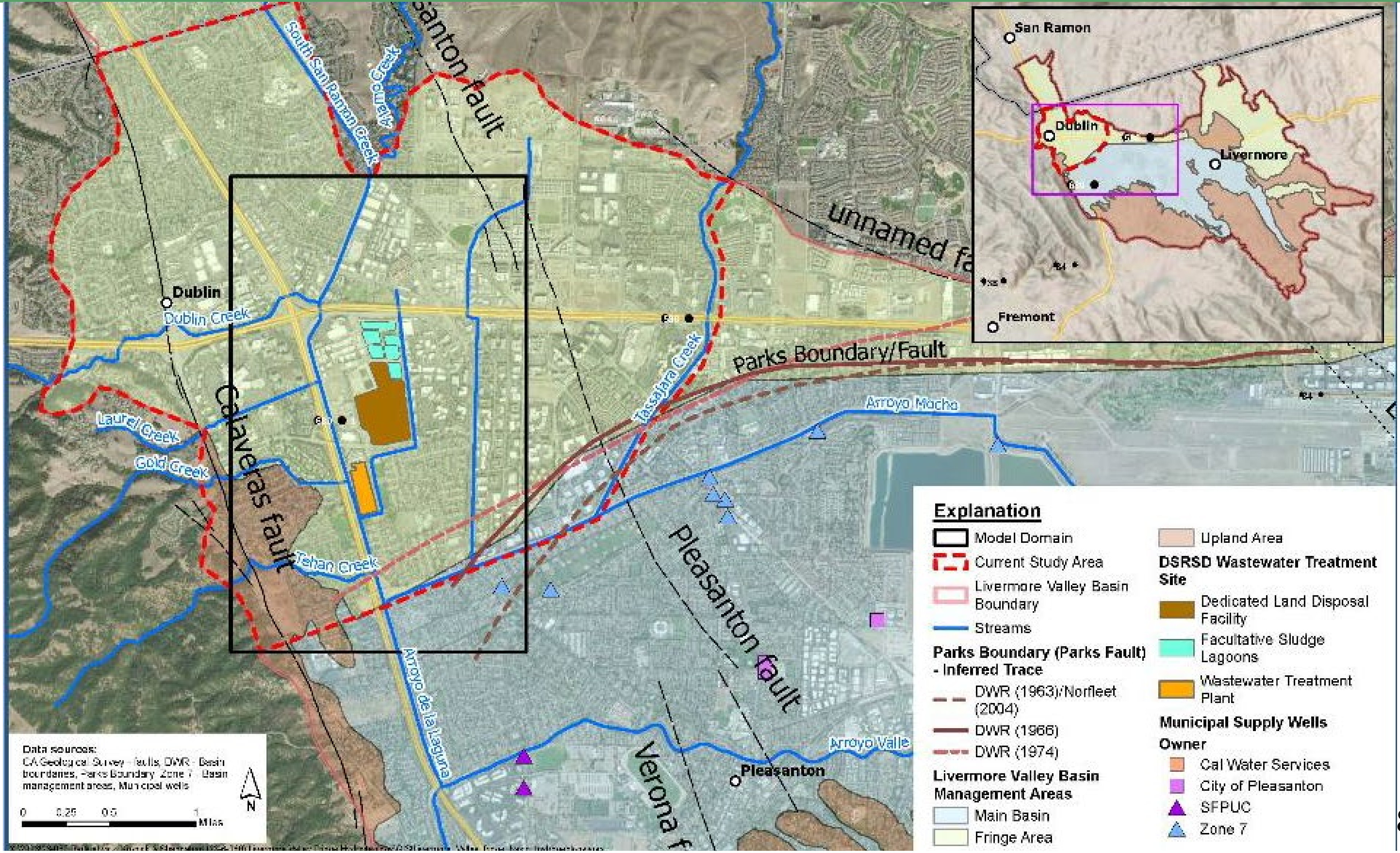
Study Area and Model Domain



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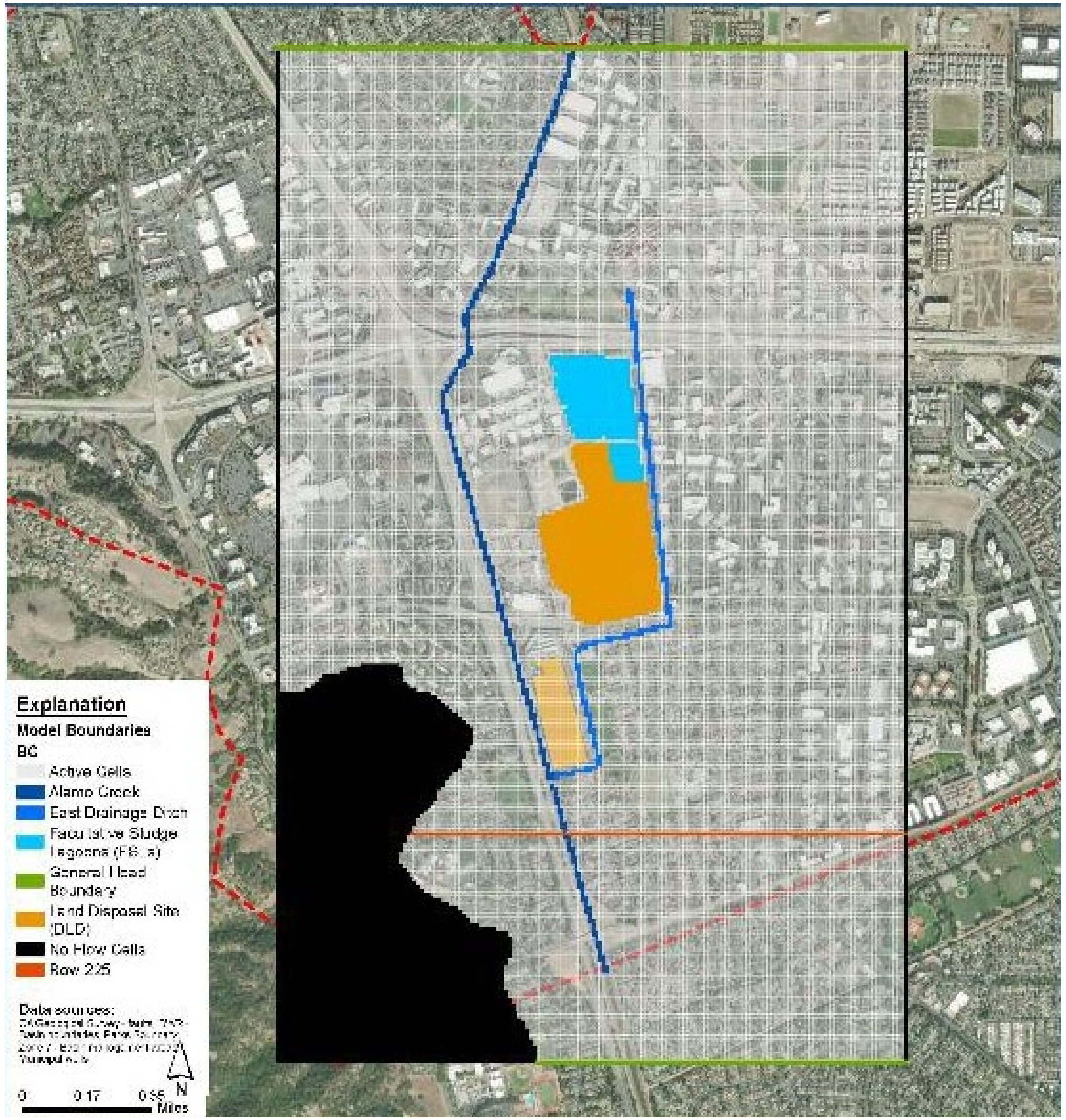
Model Domain and Key Features



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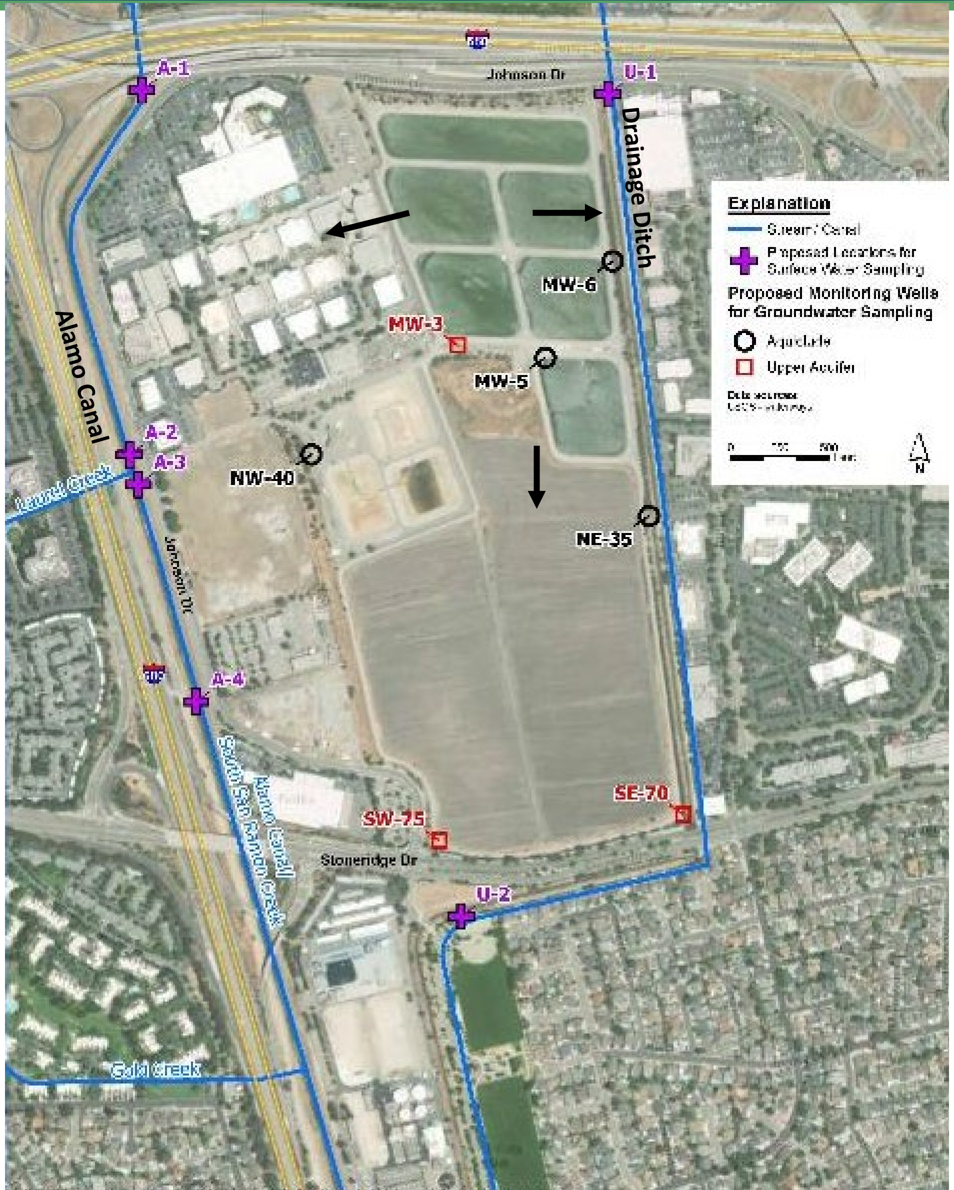
Potential Migration Pathways



- East to Drainage Ditch
- West to Alamo Canal
- Vertical through Aquitard and South in Upper Aquifer

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General Model Findings – Flow Rates and Migration Pathways

- Total FSL/Pond infiltration estimate = 1.1 acre-feet/year (AFY)
- Potential off-site migration pathways/endpoints: East Drainage Ditch, Alamo Canal, and downgradient in groundwater
- Estimates of infiltrating FSL water to three endpoints: 0.25, 0.45, and 0.4 AFY
- Estimated groundwater flow to East Drainage Ditch = 0.00035 cubic feet per second (cfs)
- Estimated groundwater flow to Alamo Canal = 0.0006 cfs

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General Findings – Travel Times

Migration Pathway	Median Travel Time from FSL to Eastern Drainage Ditch	Median Travel Time from FSL to Alamo Canal	Median Travel Time from FSL to Upper Aquifer	Median Travel Time from FSL to Off-Site Location in Upper Aquifer
Horizontal Flow in Aquiclude away from Mound	27 years (Analytical): 43 years (Numerical)	465 years (Analytical): 650 years (Numerical)		
Vertical Flow in Aquiclude beneath Mound			160 years (Analytical): 240 years (Numerical)	
Horizontal Flow in Upper Aquifer				10 years (Analytical): 25 years (Numerical)

Notes: Analytical travel times are discrete (single particle) calculations vs. Numerical Model travel times based on median travel time of several particle tracks

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Recycled Water Analysis

Recycled Water Analysis

- Preliminary analysis conducted on areas with application of recycled water for irrigation
  - Comparison of locations of parcels receiving recycled water for irrigation vs. location of PFOS Footprint mapped by Zone 7

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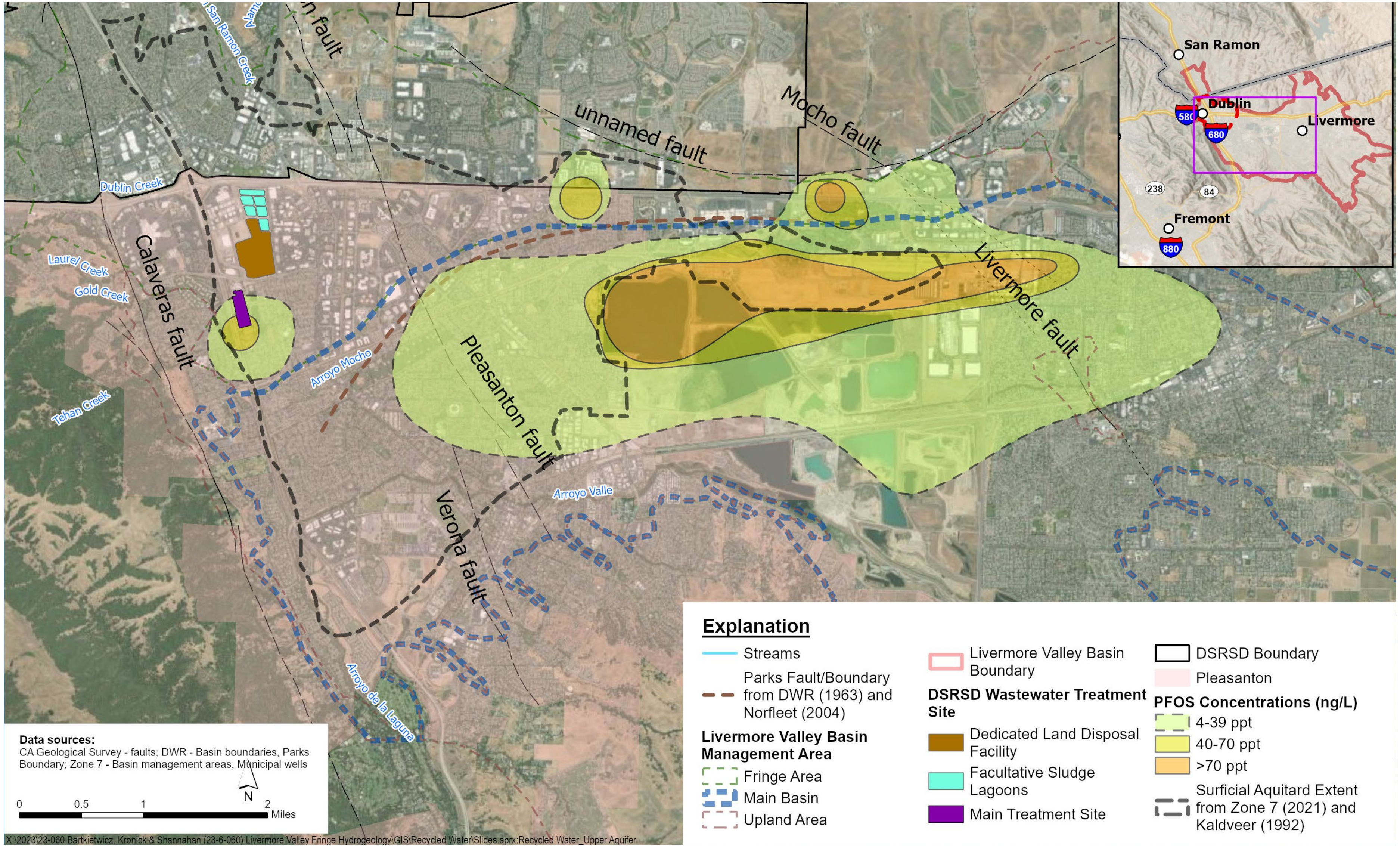
Recycled Water Analysis

Upper Aquifer PFOS Footprint vs. Recycled Water Parcel Locations



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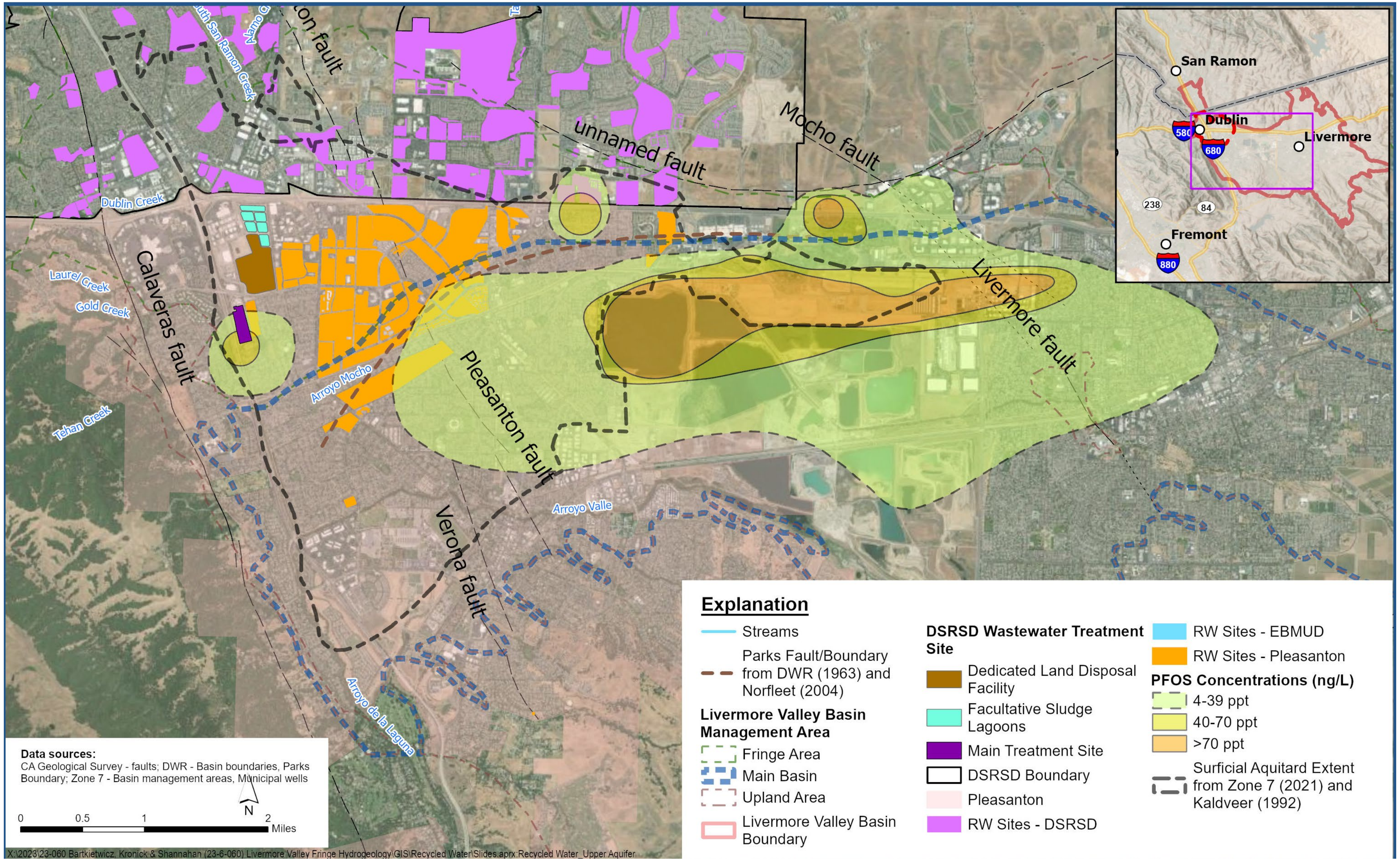
Recycled Water Analysis

Upper Aquifer PFOS Footprint vs. Recycled Water Parcel Locations



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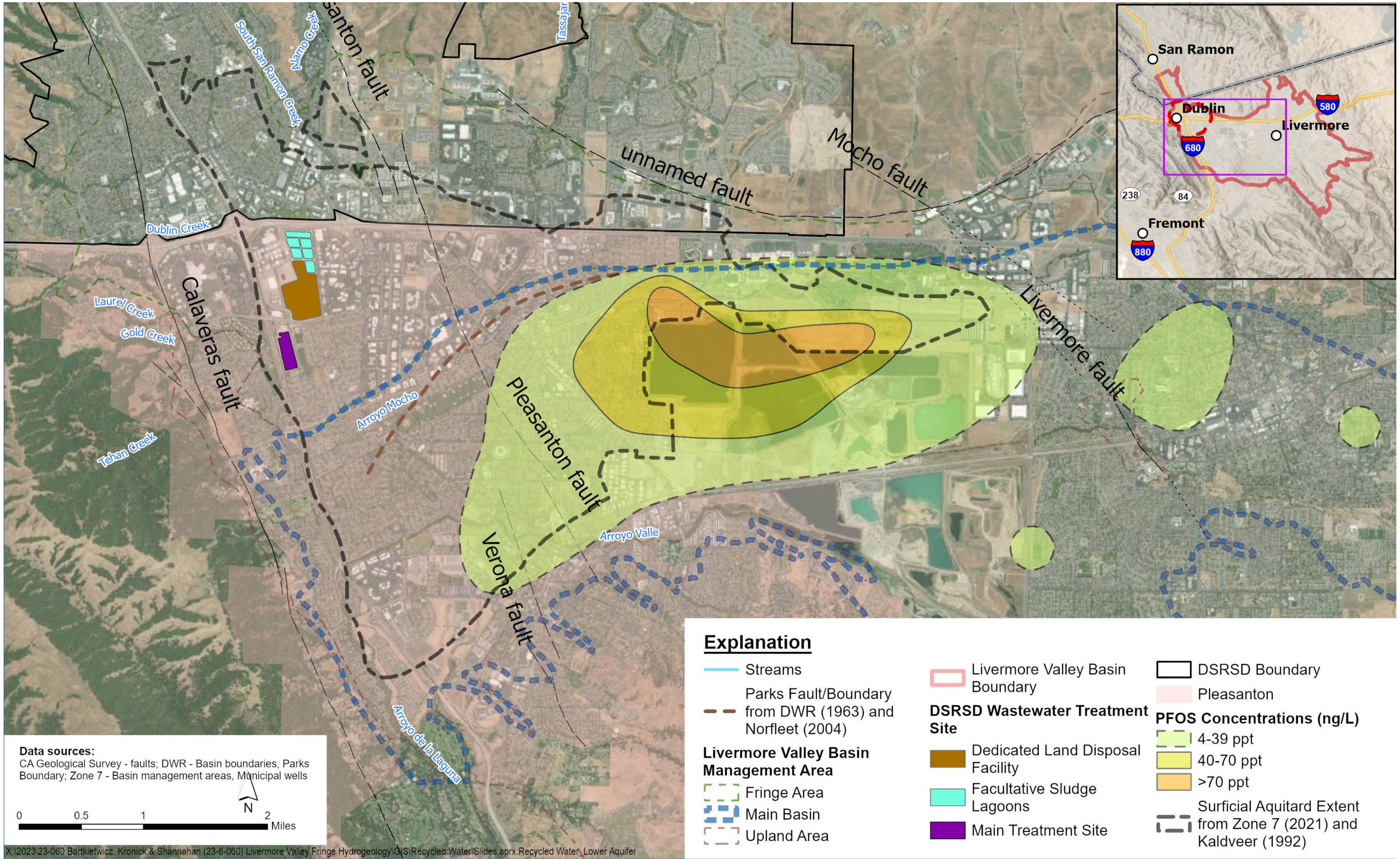
Recycled Water Analysis

Lower Aquifer PFOS Footprint vs. Recycled Water Parcel Locations



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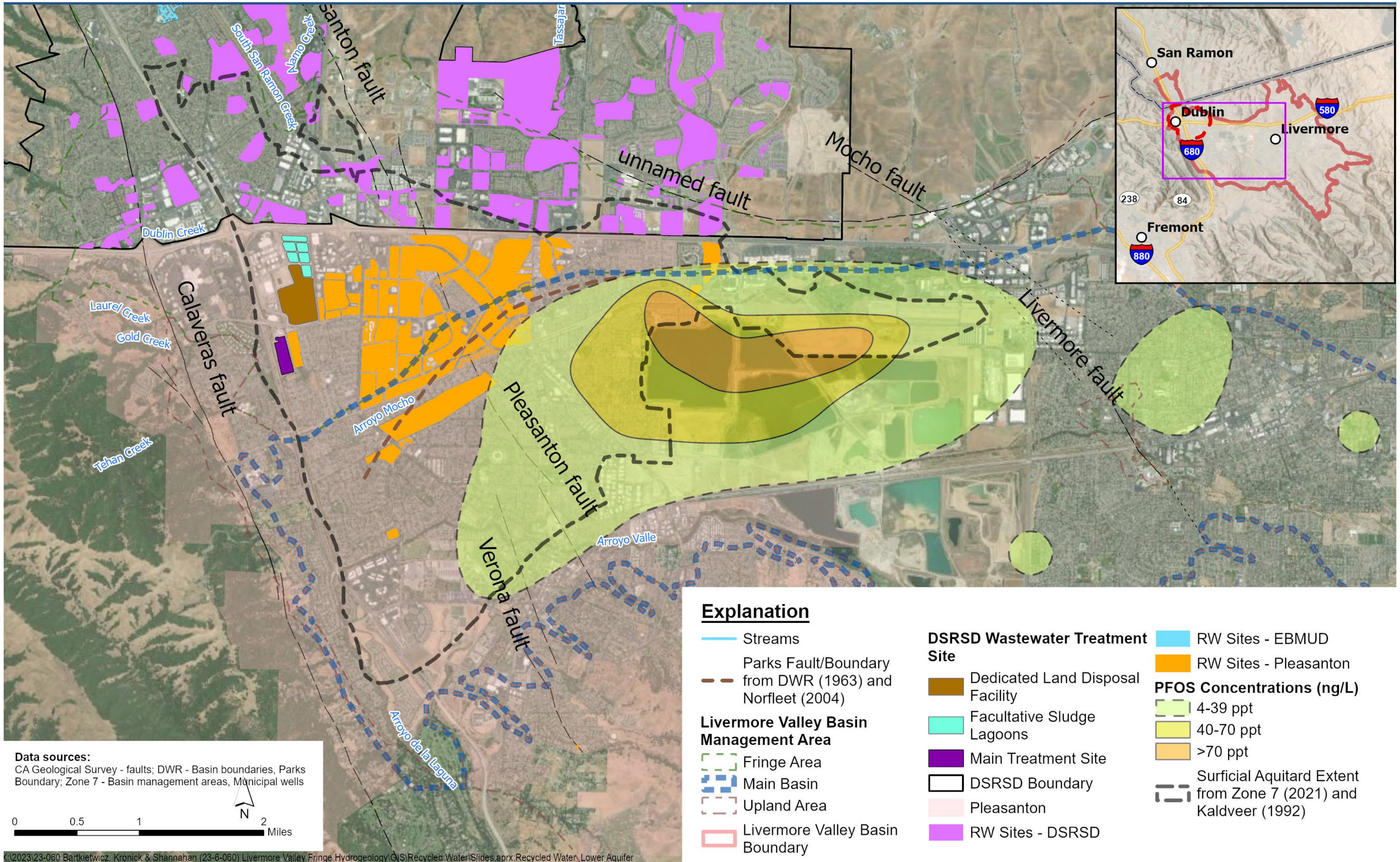
Recycled Water Analysis

Lower Aquifer PFOS Footprint vs. Recycled Water Parcel Locations



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Main Conclusions

- The presence of a 50-foot thick, low permeability clay layer underneath DSRSD facilities and recycled water sites strongly impedes the movement of constituents, including PFAS, to off-site locations
- No indication that DSRSD wastewater or recycled water operations have contributed to Main Basin PFOS footprint

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Questions?

Back up slides

PFAS Uses

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REVIEW ARTICLE

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Historical and current usage of per- and polyfluoroalkyl substances (PFAS): A literature review

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An overview of the uses of per- and polyfluoroalkyl substances (PFAS)

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- Contact lenses and eye drops
- Guitar strings
- Cement additive to reduce shrinkage
- Ultrapure water systems - polymeric PFAS are used as filter
- Adhesives in tape or Post-It Notes
- Artificial heart pumps
- Dental floss
- Band-aids
- Toilet paper
- Toner and printer ink
- Tennis racket coating
- Climbing ropes
- Ski wax
- Bike lubricants
- Windshield wiper fluid
- Brake pad additive…

Data Source
1. https://onlinelibrary.wiley.com/doi/epdf/10.1002/ajim.23362
2. https://pubs.rsc.org/en/content/articlelanding/2020/em/d0em00291g

ZONE 7 WATER AGENCY

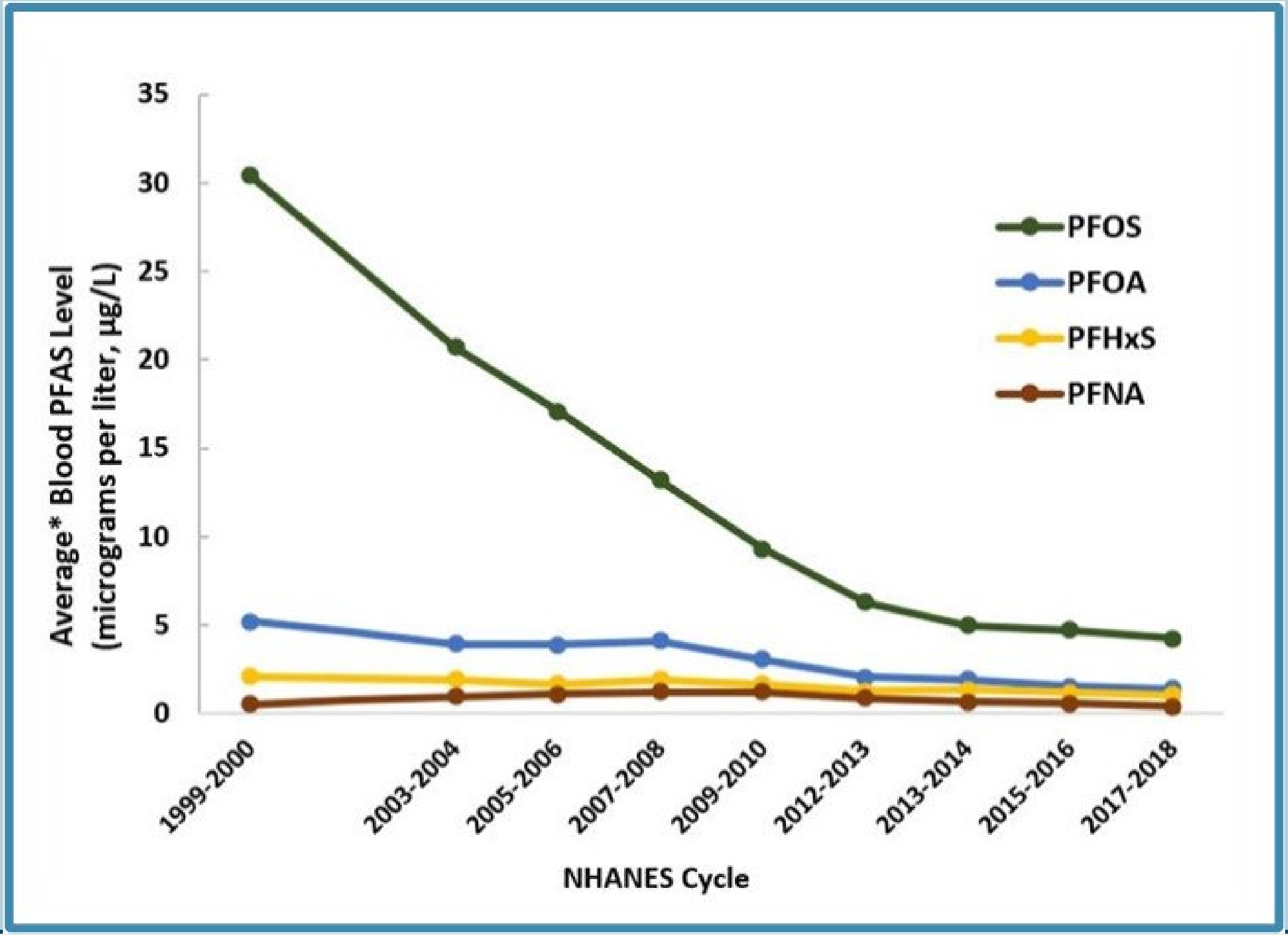
PFAS in Blood Serum

- Most (97–100%) of US population has PFAS in their blood serum

PFAS Concentrations in Blood (µg/L, ppb) in the US General Population			
Year	**PFOS**	**PFOA**	**PFHxS**
1999 - 2000	30.4	5.2	2.1
2017 - 2018	4.3	1.4	1.1

- PFOS and PFOA have been phased out of use in the US

CDC's National Health and Nutrition Examination Survey (NHANES) Program



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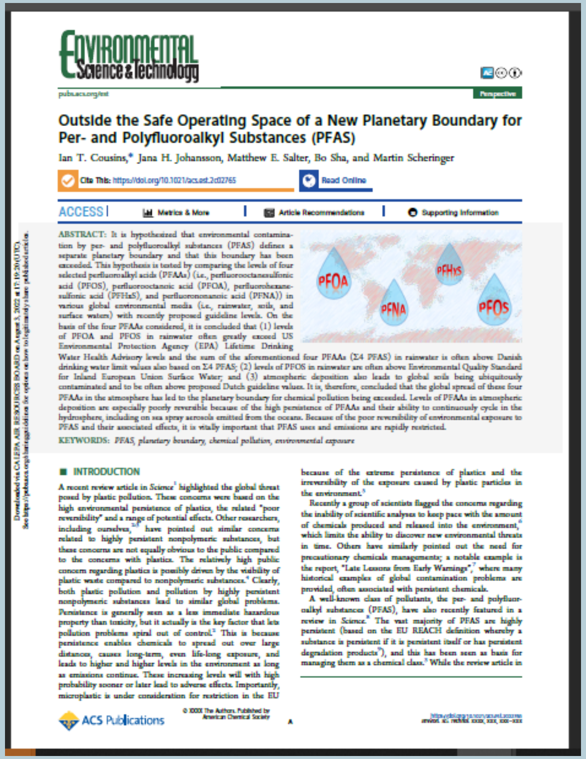
Data Source: https://www.atsdr.cdc.gov/pfas/health-effects/us-population.html

PFAS in Rain



- Levels of PFAS in rainwater collected world-wide often greatly exceed US and global health advisories…

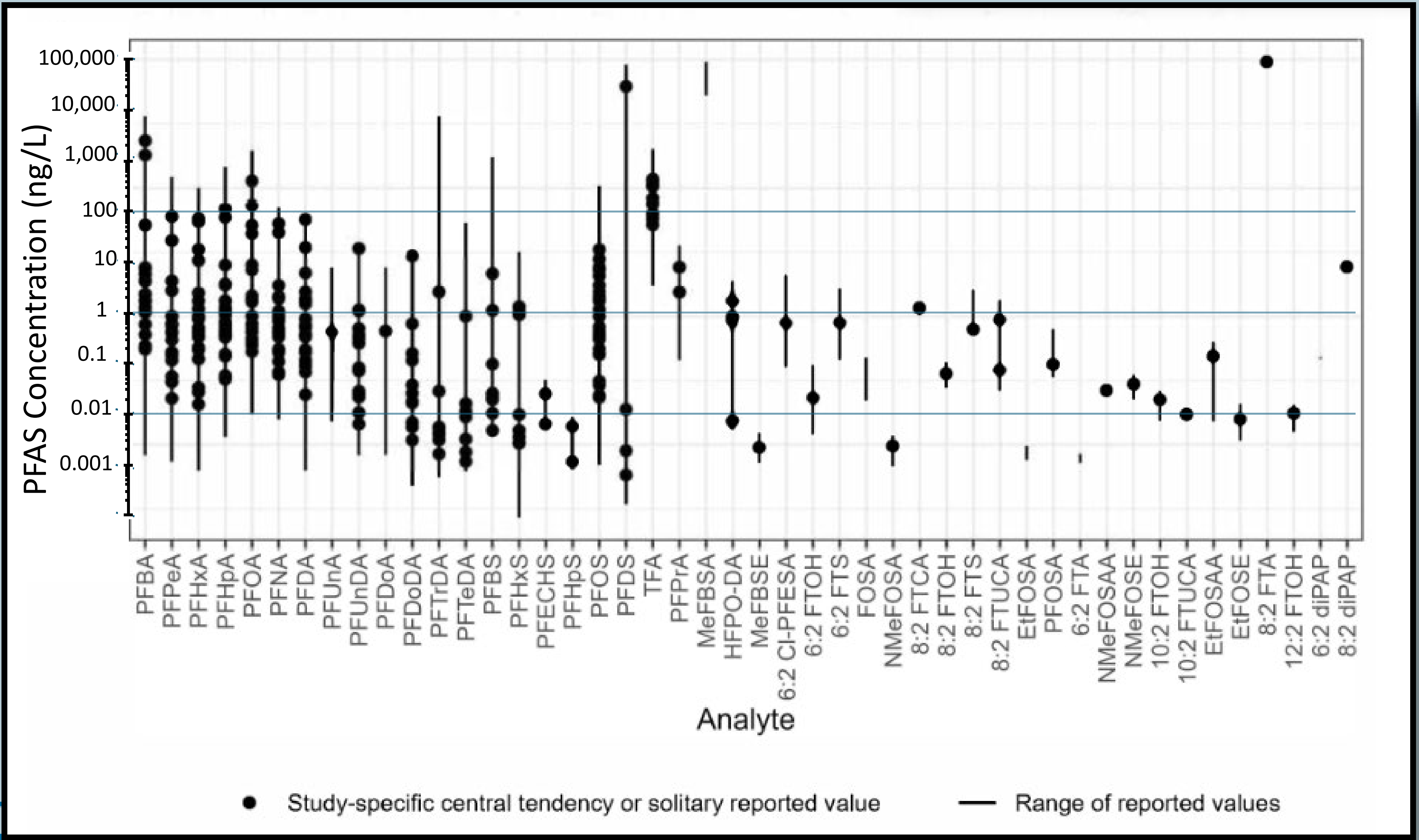
- PFOS:
  - USEPA (interim) health advisory = 0.02 ppt
  - Mean concentration in “urban” US rain* = 4.9 ppt
- PFOA:
  - USEPA (interim) health advisory = 0.004 ppt
  - Mean concentration in “urban” US rain* = 2.1 ppt

* PFAS concentrations in US rain samples are from one study (Pike et al, 2021) with samples from 6 locations in the US. (Not a comprehensive set of data.)

Zone 7 Water Agency

Data Source: https://pubs.acs.org/doi/10.1021/acs.est.2c02765

PFAS in Rain



Data Source: https://pfas-1.itrcweb.org/6-media-specific-occurrence

Regional Cleanup Program Investigations

ZONE 7 WATER AGENCY