RO Concentrate Management, Nutrients, and Water Reuse Projects in the South Bay

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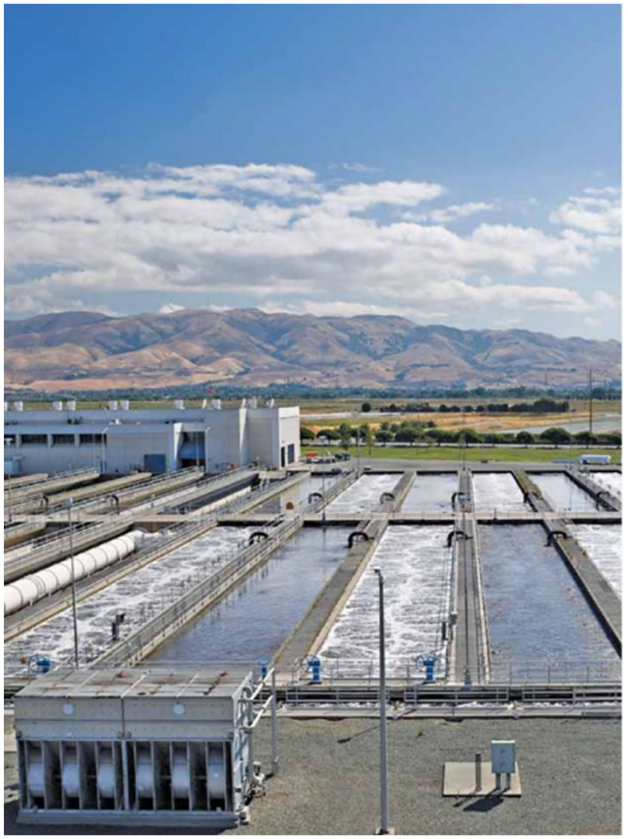
April 29, 2025

San Jose-Santa Clara Regional Wastewater Facility

- Operating since 1956
- One of the largest advanced wastewater facilities in West
  - 167 MGD dry-weather permitted capacity
- Serves
  - 1.5 million people
  - 17,000 businesses
  - 8 cities & County
- Receives over 23,000 kg/d of nitrogen (influent load)



San José-Santa Clara Regional Wastewater Facility

San Jose-Santa Clara Regional Wastewater Facility

- Removes 80% of incoming nitrogen
  - Early action treatment upgrades
  - Non-potable recycled water (16 mgd average dry season)
  - Optimization (2019 to present)
- Discharges to the vulnerable Lower South Bay
  - Long hydraulic residence time
  - Supports abundant and diverse wildlife

San José-Santa Clara Regional Wastewater Facility

San Jose-Santa Clara Regional Wastewater Facility

- Advanced wastewater treatment: very clean effluent discharged to vulnerable habitat
- Supports abundant and diverse fish, bird, mammal and invertebrate communities
- Vulnerability remains due to limited available dilution
- Need to balance multiple water use and water demands (process, human, environment)

San José-Santa Clara Regional Wastewater Facility

Lower South Bay 2022 Bloom Conditions

Conditions didn't degrade in Lower South Bay like in South and Central Bays.

Healthy and abundant fish in Lower South Bay August 2022

Photo Credits: James Ervin

Green (not brown) water.
H. akashiwo present but at lower concentrations.

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San Jose-Santa Clara Regional Wastewater Facility

Options under evaluation to comply with long-term nutrient limits

Treatment Process Upgrades

Increased Water Recycling

Nature-based Solutions

Santa Clara Valley Water District (Valley Water)

- **15** Cities
- **2,000,000** People
- **13** Local water providers
- **4,700** Direct well owners

Valley Water

Silicon Valley Advanced Water Purification Center (SVAWPC)

- In partnership with the City of San Jose
- Feedwater to SVAWPC is San Jose/Santa Clara Regional Wastewater Facility
- Largest advanced water purification plant in Northern California, 8MGD
- Enhancement of water quality for approximately 1000 users of recycled water in Santa Clara County

Silicon Valley Advance Water Purification Center (SVAWPC)

Valley Water

San José-Santa Clara Regional Wastewater Facility

Potable Reuse Goal: Project Commitment

- Developing a locally controlled and resilient water supply
- 24,000 AFY by 2035 – focus on San José DPR Purified Water Project in collaboration with the Cities of San José and Santa Clara
- 32,000 AFY – potential purified water production

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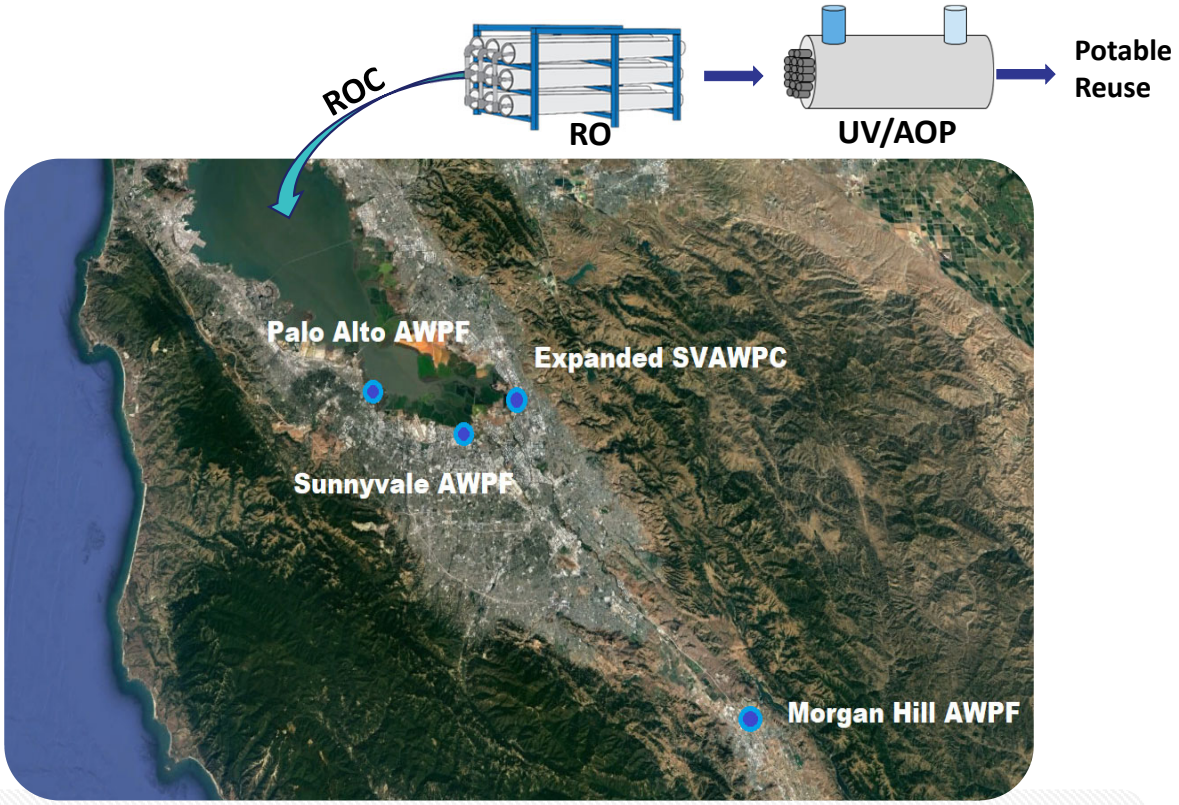
Advanced Water Purification Facilities & RO Concentrate (ROC) Management Challenge

- Limits and constraints associated with ROC discharge
- May require nutrient, metals, and trace organic contaminant removal
- Nitrogen load caps and CECs present additional challenges



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ROC Management Options

- Blending/Dilution with treated wastewater prior to discharge
- Discharge to sewer or directly to regional treatment plant
- Minimize ROC and dispose of solid waste in landfill (e.g., evaporation)
- Full flow or partial side-stream treatment (e.g., physical-chemical or nature-based solutions) then discharge or use for habitat restoration

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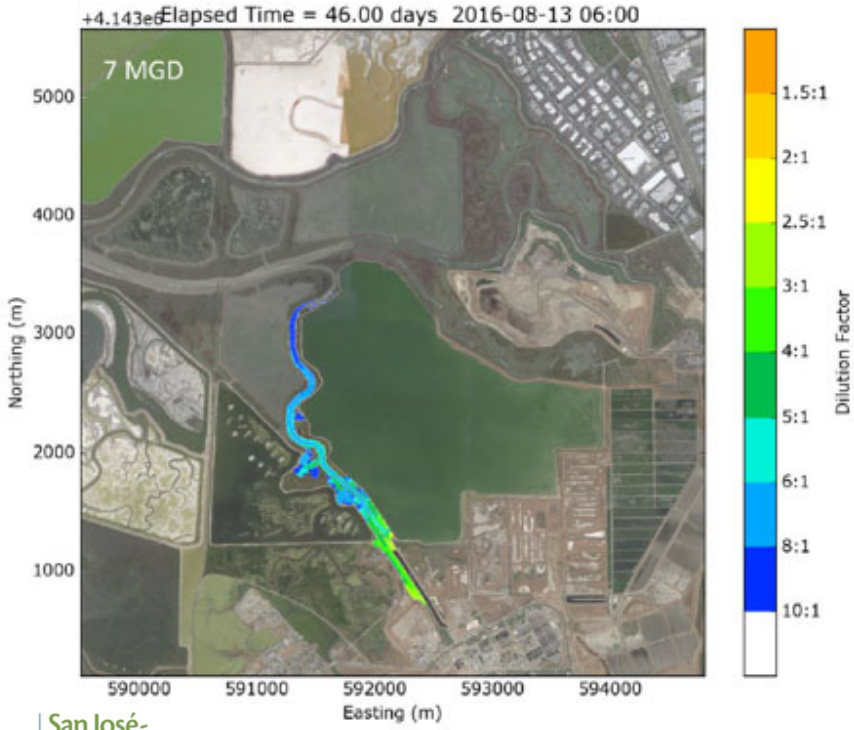
ROC Studies to Evaluate Blending with the Residual Effluent

- Hydrodynamic Modeling
  - SFEI-DFM model used for performing the ROC dilution studies in the Lower South Bay
- Reasonable Potential Analysis
  - Identified constituents that would require effluent limits for priority pollutants
- Mass Balance and Effluent Limits Analysis
  - Identified dilutions needed for the constituents identified under RPA (Selenium, Cyanide, Mercury, Copper)
- Toxicity Analysis
- Constituents of Emerging Concerns (CECs)



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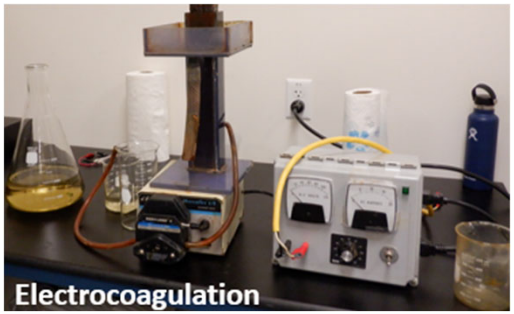
Physicochemical and Biological Treatment Options

	Treatment Type	Partners	Start Date/ Duration	Completion Date/ Status	Findings	Limitations
Electrocoagulation	Physio-Chemical/ Bench Scale	Powell Water Systems	2019	2019/ Completed	Removed free metal ions, selenium, hardness, organic compounds and phosphate	Requires pre-filtration High energy use and costs
Capacitive Coagulation	Physio-Chemical Treatment/ Pilot	Carollo Engineers, PowerTech Water	December 2019/ 5 months	May 2020/ Completed	Potential to remove free metals, chelated metals, and some toxicity	High maintenance costs No commercial scale systems
Ozone/ Biological Activated Carbon	Biological/ Pilot	Stanford	2018/ 11 months	2018/ Completed	Partial nitrate removal, ozone enhanced removal of trace organics	Would not remove all potential contaminants


Electrocoagulation

Ozone/Biological Activated Carbon


Capacitive Coagulation

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Nature Based Solution

- Engineered Treatment Cells (2017-2019)
- Floating Wetland Treatment (2020-2023)
  - Reduced nutrients and organic contaminants
  - Limited reduction of metals
- Horizontal Levee (2019-Present)
  - Phase I ended in 2022 and yielded encouraging results indicating that cells receiving ROC exhibit removal of nutrients, trace organic contaminants and copper
  - Phase II reconstruction of cells and focus more on metals and PFAS





SFEI Aquatic Science Center · Stanford University · Berkeley University of California · Oro Loma Sanitary District · EBDA East Bay Dischargers Authority · Intrinsyx Environmental · Humboldt State University

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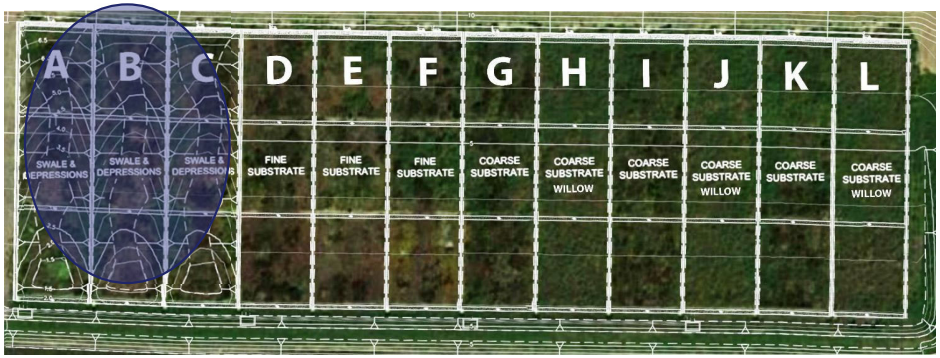
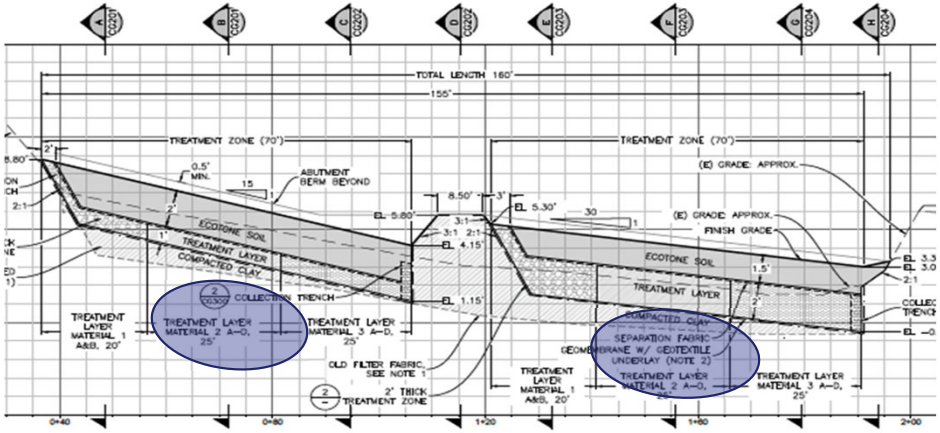
Redesign for Footprint and PFAS Removal

Phase II (2022 – 2026)

Source Credit: Oro Loma Sanitary District, and UC Berkeley





Activated Carbon

Fluorosorb

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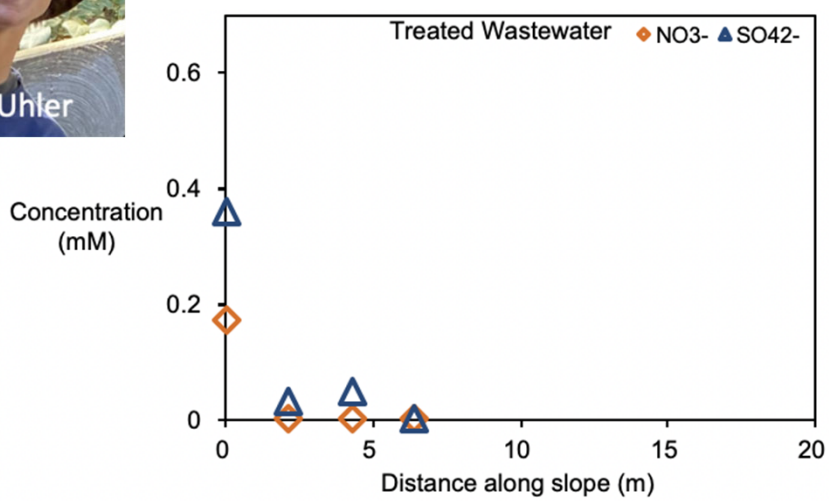
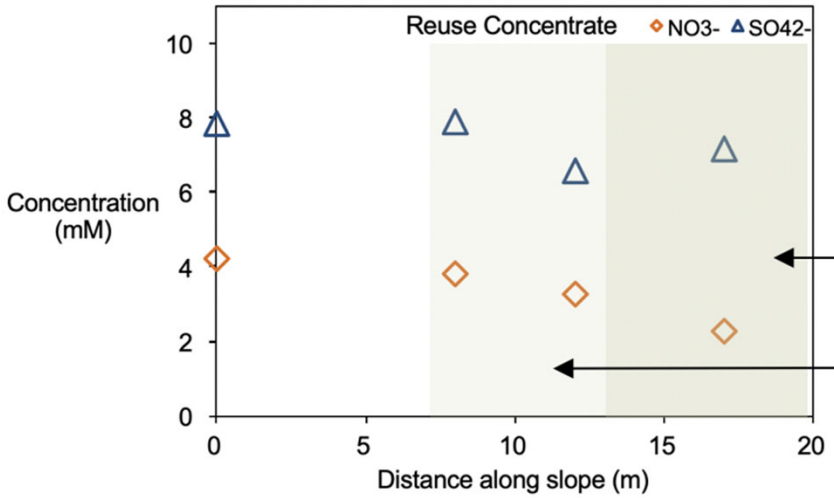
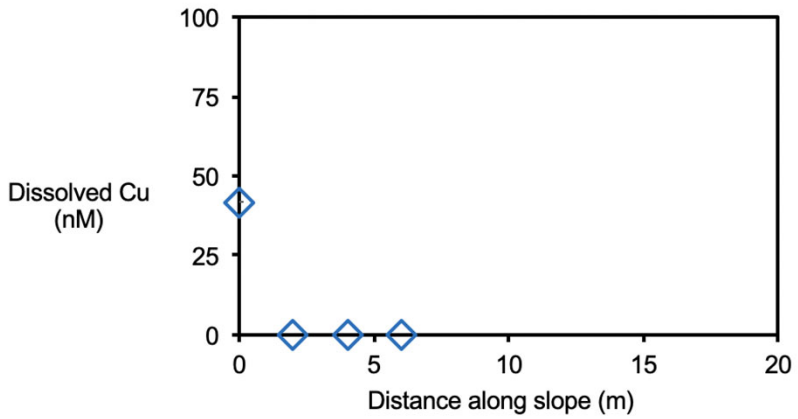
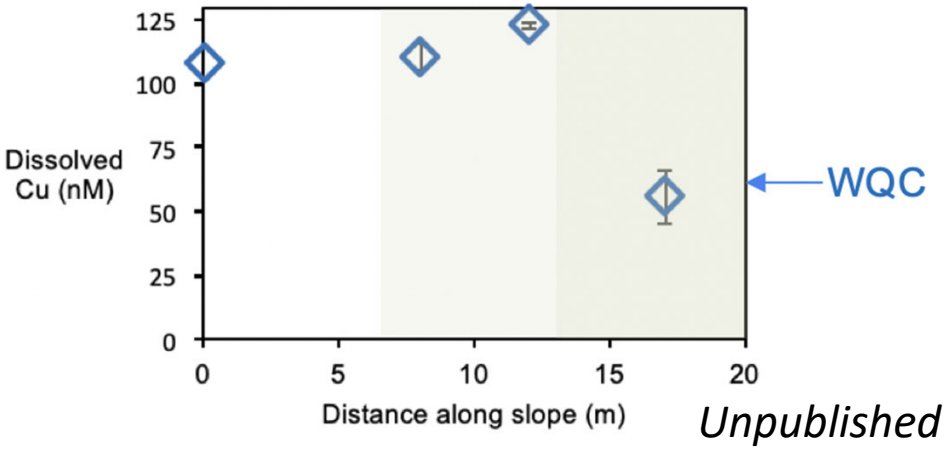
Influence of nitrate on Cu removal







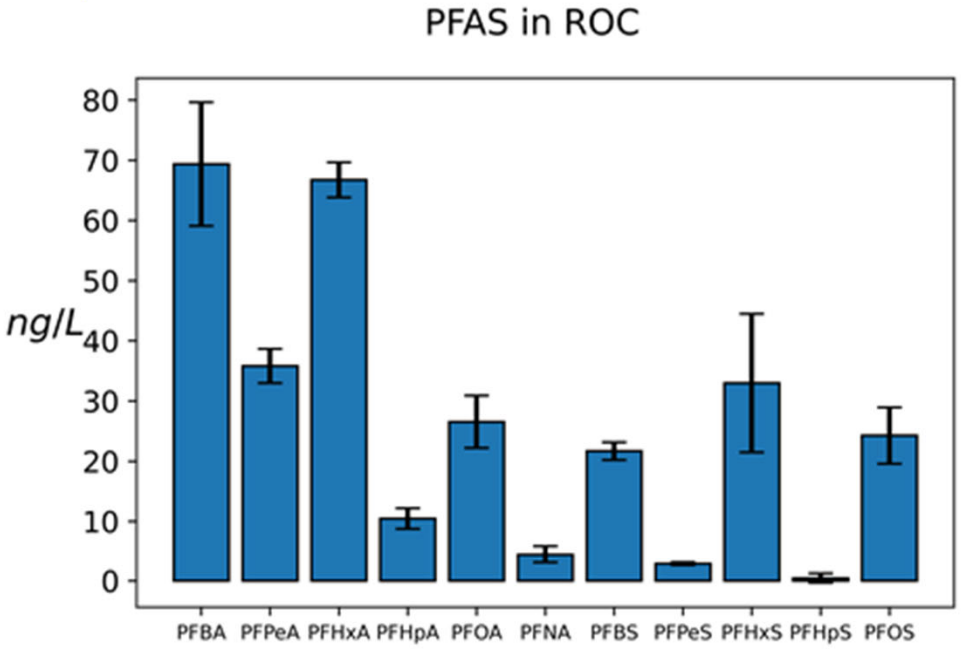


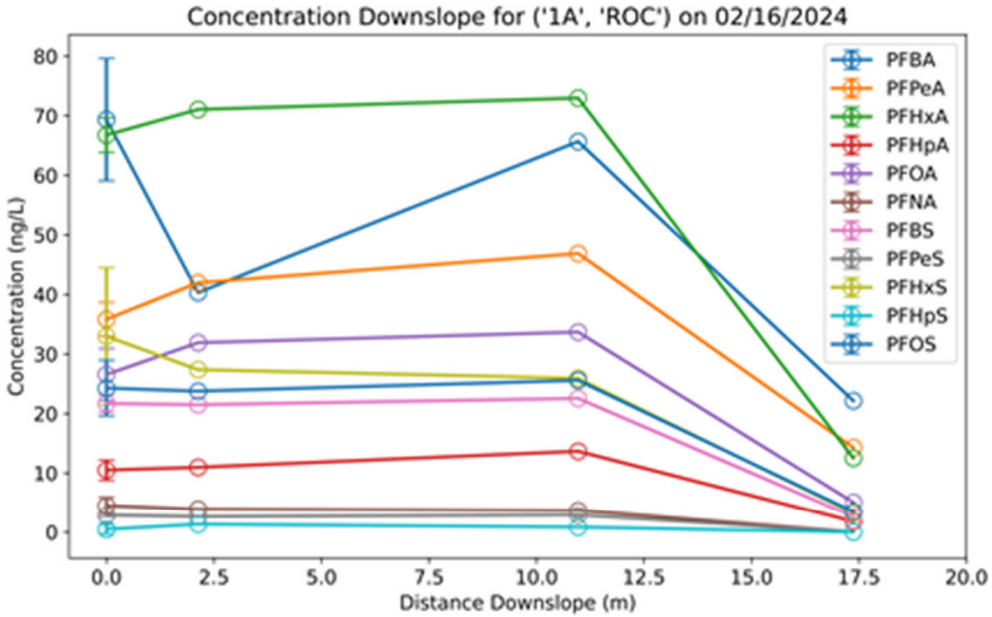
Unpublished Data

Anthony DeSalvo

PFAS Removal

Berkeley
UNIVERSITY OF CALIFORNIA





Unpublished Data

Meetings: Regional Water Board, San Jose, and Valley Water

- Concentrate discharge through the RWF outfall and Artesian Slough may be feasible short-term (acceptable volume of ROC may be constrained)
- In the long-term or at higher volumes, compliance strategy will need to include NbS or advanced treatment to reduce loads of nutrients and CECs
- Ongoing discussions on nutrient discharges and management practices will ensure compliance
- Valley Water and San Jose will continue exploring NbS and advanced treatment options for concentrate management compliance

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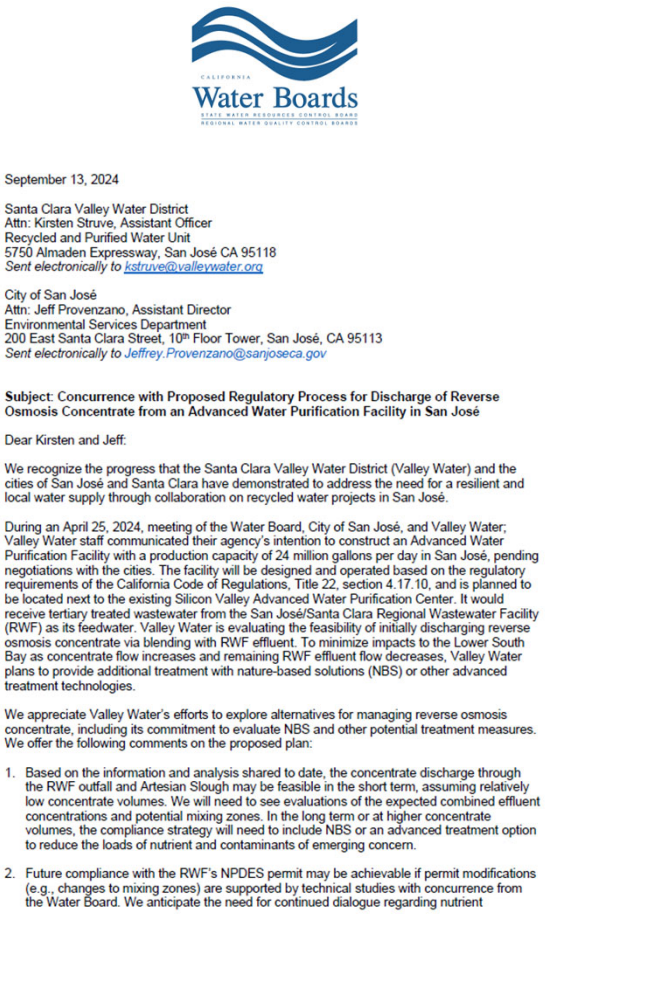

California Water Boards

September 13, 2024

Santa Clara Valley Water District
Attn: Kirsten Struve, Assistant Officer
Recycled and Purified Water Unit
5750 Almaden Expressway, San José CA 95118
Sent electronically to kstruve@valleywater.org

City of San José
Attn: Jeff Provenzano, Assistant Director
Environmental Services Department
200 East Santa Clara Street, 10th Floor Tower, San José, CA 95113
Sent electronically to Jeffrey.Provenzano@sanjoseca.gov

Subject: Concurrence with Proposed Regulatory Process for Discharge of Reverse Osmosis Concentrate from an Advanced Water Purification Facility in San José

Dear Kirsten and Jeff:

We recognize the progress that the Santa Clara Valley Water District (Valley Water) and the cities of San José and Santa Clara have demonstrated to address the need for a resilient and local water supply through collaboration on recycled water projects in San José.

During an April 25, 2024, meeting of the Water Board, City of San José, and Valley Water; Valley Water staff communicated their agency's intention to construct an Advanced Water Purification Facility with a production capacity of 24 million gallons per day in San José, pending negotiations with the cities. The facility will be designed and operated based on the regulatory requirements of the California Code of Regulations, Title 22, section 4.17.10, and is planned to be located next to the existing Silicon Valley Advanced Water Purification Center. It would receive tertiary treated wastewater from the San José/Santa Clara Regional Wastewater Facility (RWF) as its feedwater. Valley Water is evaluating the feasibility of initially discharging reverse osmosis concentrate via blending with RWF effluent. To minimize impacts to the Lower South Bay as concentrate flow increases and remaining RWF effluent flow decreases, Valley Water plans to provide additional treatment with nature-based solutions (NBS) or other advanced treatment technologies.

We appreciate Valley Water's efforts to explore alternatives for managing reverse osmosis concentrate, including its commitment to evaluate NBS and other potential treatment measures. We offer the following comments on the proposed plan:

1. Based on the information and analysis shared to date, the concentrate discharge through the RWF outfall and Artesian Slough may be feasible in the short term, assuming relatively low concentrate volumes. We will need to see evaluations of the expected combined effluent concentrations and potential mixing zones. In the long term or at higher concentrate volumes, the compliance strategy will need to include NBS or an advanced treatment option to reduce the loads of nutrient and contaminants of emerging concern.
2. Future compliance with the RWF's NPDES permit may be achievable if permit modifications (e.g., changes to mixing zones) are supported by technical studies with concurrence from the Water Board. We anticipate the need for continued dialogue regarding nutrient

Nature-based Solutions: BACWA study

- SFEI and HDR evaluated potential options for NbS at the SJ-SC RWF
- Phases I & II: identify and evaluate higher potential areas for NbS concepts
- Phase III (only 3 agencies): high level engineering cost estimates
- Three options identified at SJ-SC RWF: open-celled wetlands (2 options) and horizontal levee (1 option)
- Study focused on nitrogen removal (other benefits possible)
- NbS have broad appeal (including to our regulators) due to a multi-benefit solution for discharges (especially for ROC)

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Nature-based Solution Option 1

Open-celled treatment wetland constructed biosolids processing lagoons that are inactive.

Treatment Wetland (small)	
Size	26 Acres
Estimated Cost	$19M - $24M
Flow	3.5 MGD
TIN removal	100 kg/d

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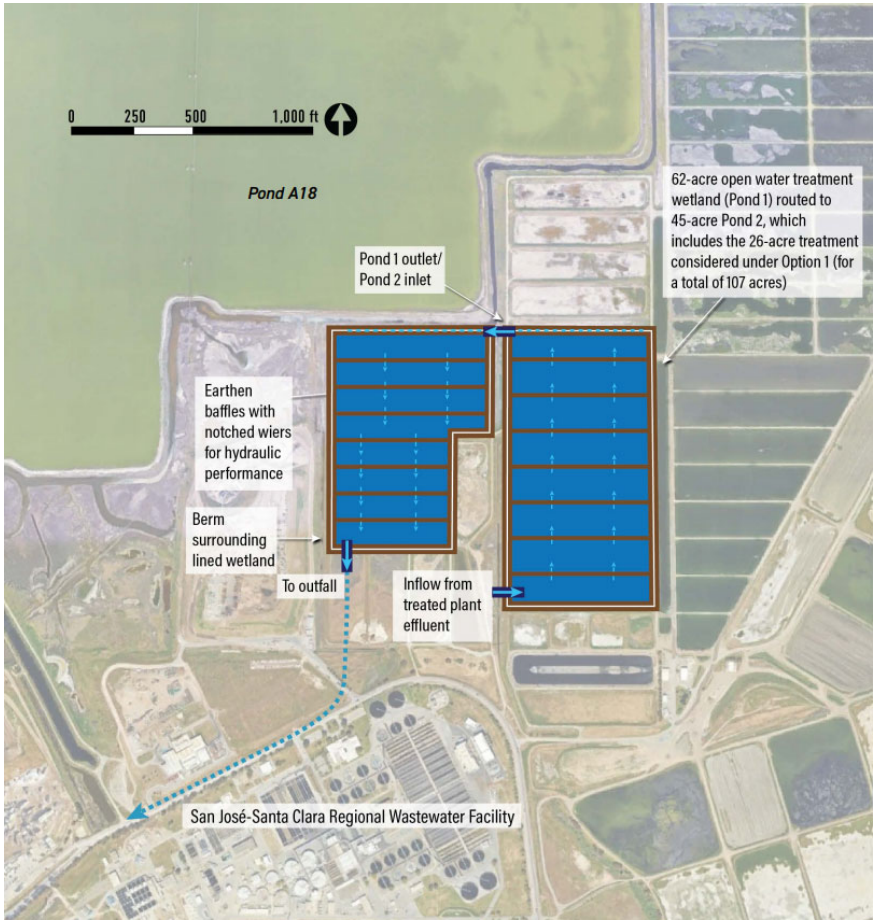
Nature-based Solution Option 2



Larger open-celled treatment wetland using additional biosolids processing lagoons to be decommissioned.

Treatment Wetland (large)	
Size	81 Acres
Estimated Cost	$58 - $94M
Flow	11 MGD
TIN removal	335 kg/d

If combined with Option 1:

- 107 acres
- 435 kg/d TIN
- ~$100 M

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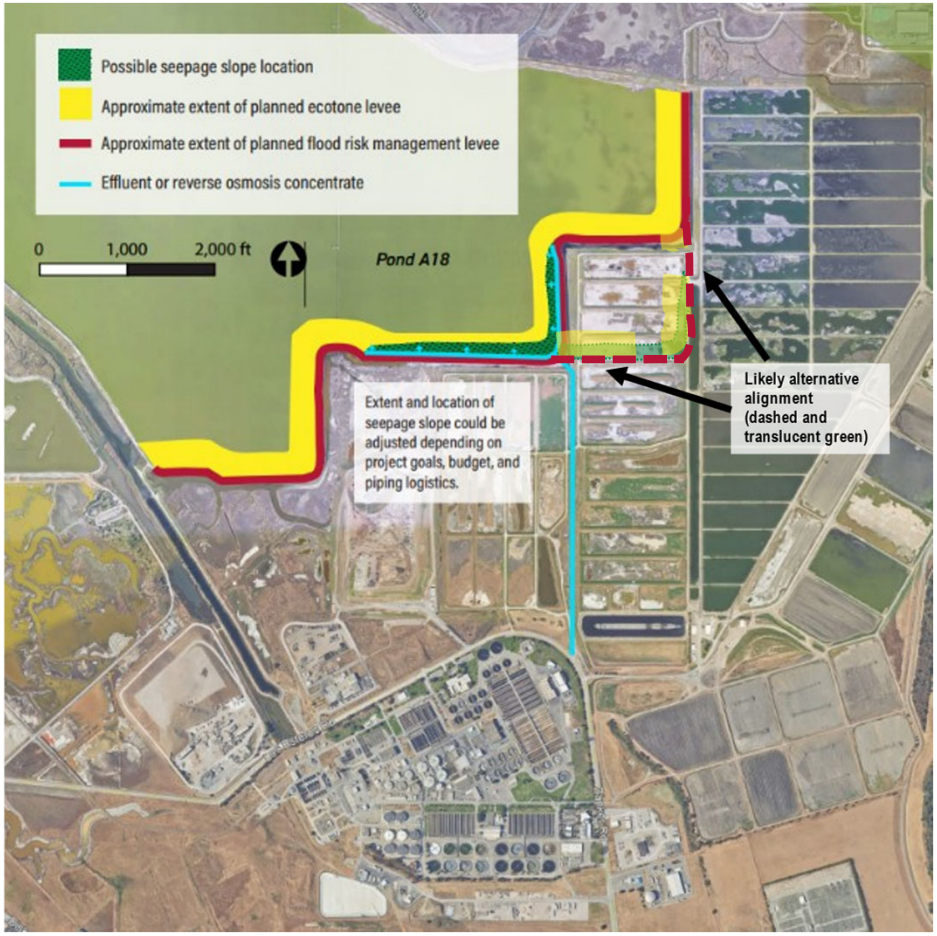
Nature-based Solution Option 3



Discharge to Horizontal Levee with seepage slope along future flood control levee that will have an ecotone feature.

Horizontal Levee with Seepage Slope	
Size	48 Acres
Estimated Cost	$45 - $55M
Flow	4 MGD
TIN removal	535 kg/d

Size is scalable up to 92 acres and as small as <1 acre. Costs and removal scale in proportion

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Nature-based Solutions: Comparison of Options

Option	Cost	TIN reduction	Acres/kg TIN	$/kg TIN
Treatment Wetland (26 Acre)	$21.5 M	100 kg/d	0.26 acres	$215,000
Treatment Wetland (81 Acre)	$76 M	335 kg/d	0.24 acres	$226,700
Treatment Wetland (107 Acre)	$98 M	435 kg/d	0.25 acres	$225,300
Horizontal Levee (48 Acre)	$55 M	535 kg/d	0.09 acres	$102,800

- None of these options would be sufficient to treat all effluent from SJ-SC RWF.
- These would be most useful as partial flow treatment or side-stream style treatment for high strength flows such as ROC

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Next Steps and Summary

- Next: evaluate feasibility of NbS implementation and other treatment pathways as management options for ROC.
- Determining targeted volume for NbS scale up analysis to inform acres and CAPEX.
- Further refine and evaluate OPEX for NbS.
- Evaluate other pollutant removal and associated benefits.
- Engagement with other SJ and VW partners on conceptual evaluations and feasibility.

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QUESTIONS