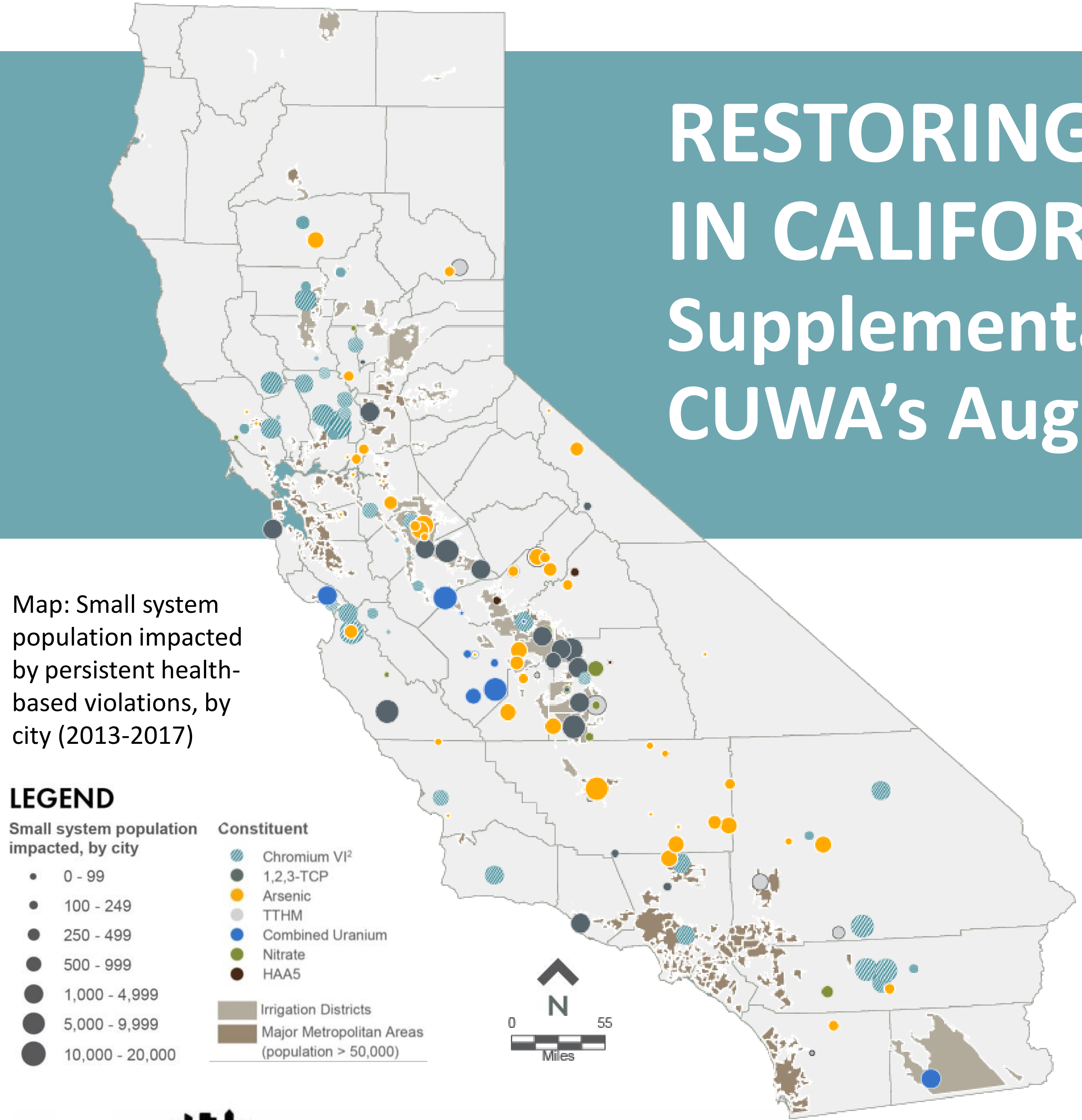
RESTORING WATER ACCESSIBILITY IN CALIFORNIA:

Supplemental Information to Support CUWA's August 2018 Issue Brief



Map: Small system population impacted by persistent health-based violations, by city (2013-2017)

OBJECTIVE:

Guide solutions for lasting improvements that break the cycle of failing water systems delivering unsafe drinking water.

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BACKGROUND
Why we are doing this work?

- Failing systems provide unsafe drinking water to hundreds of thousands of people in California.
- Many entities, including CUWA, have studied the challenges, but because achieving progress has been slow, the struggle continues.
- While the State assesses funding options, **immediate progress can be made** to address some of these systems.
- CUWA is positioned to inform technical solutions that dovetail with institutional and operational solutions for creating long-term sustainability.

IMMEDIATE ACTIONS CAN LEAD TO PROGRESS

1

IDENTIFY WHICH SYSTEMS TO ADDRESS FIRST. Create immediate, significant progress toward water quality compliance by initially focusing on small systems (<10,000 people served) with the greatest population impacted by persistent water quality violations as well as other systems in need within close proximity of these high-priority areas.

2

DEVELOP A STRATEGY TO ACHIEVE COMPLIANCE. Institutional, technical, and operational changes may be needed to realize full benefits. Components of the strategy may include:

- Make institutional changes such as grouping systems to eliminate redundant overhead and create more technical, managerial, and financial (TMF) capacity.
- Apply treatment technologies that are proven, cost-effective and reliable with simplified operational scenarios where possible while exploring means to customize and scale solutions appropriately.
- Develop a long-term strategy to support self-sustaining revenue and leverage the expertise of others for Operations and Maintenance (O&M) assistance.

3

PREVENT NEW, UNSUSTAINABLE SYSTEMS FROM FORMING. Prevent new failures by strengthening TMF capacity requirements and increasing coordination with all entities that may impact or influence development of water supplies.

Data sources for small system violations

CUWA evaluated community water systems (i.e., public water systems (PWS) that supply water to the same population year-round) and non-transient, non-community PWS (e.g., schools and day care centers) with health-based drinking water violations using California's Human Right to Water (HR2W) database between 2013-2017 as a starting point.

CUWA supplemented the HR2W data with two additional sources:

- Concentrations of 1,2,3-Trichloropropane (1,2,3-TCP) and Chromium VI were downloaded from the State Water Resources Control Board (SWRCB) Electronic Data Transfer (EDT) Library.
- Total coliform violations and system populations were downloaded from the U.S. Environmental Protection Agency (US EPA) Safe Drinking Water Information System (SDWIS).

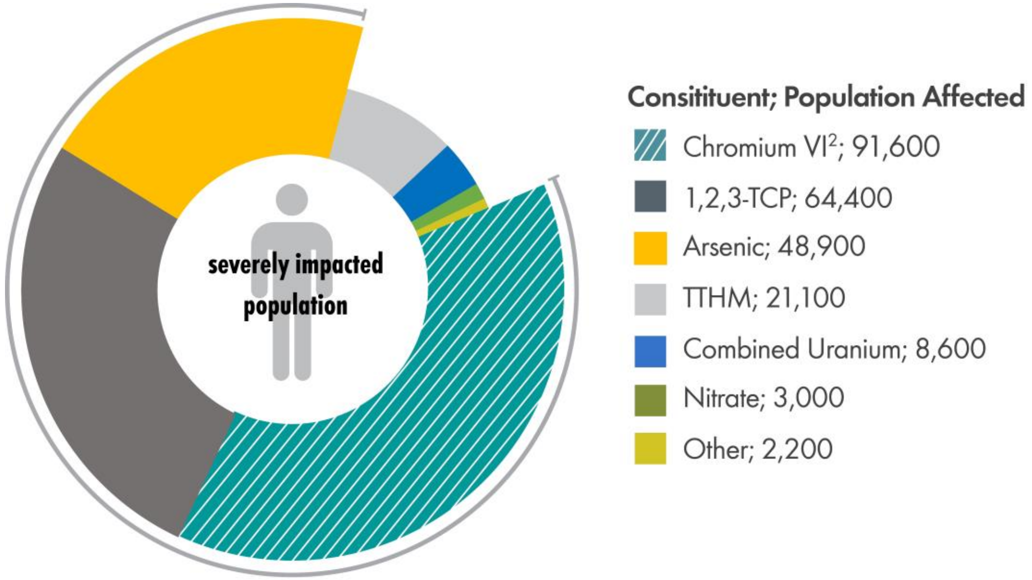
CUWA focused on small systems (i.e., systems serving <10,000 people) because many of these systems do not have sufficient resources to address water quality violations.

CUWA evaluated how many violations of a particular contaminant occurred over time and defined a "persistent violation" as a health-based violation occurring in at least 12 of the last 20 quarters (2013-2017). Persistent violations indicate a more systemic issue that needs to be addressed.

1 IDENTIFY WHICH SYSTEMS TO ADDRESS FIRST

Focus on the most pervasive, **persistent contaminants**

Total Population Served by Small Systems with Persistent Violations: **137,500**[1]



[1] More than 10,000 of these people are affected by multiple contaminants
[2] Chromium VI values represent potential future violations. The population affected by Chromium VI is not included in the total.

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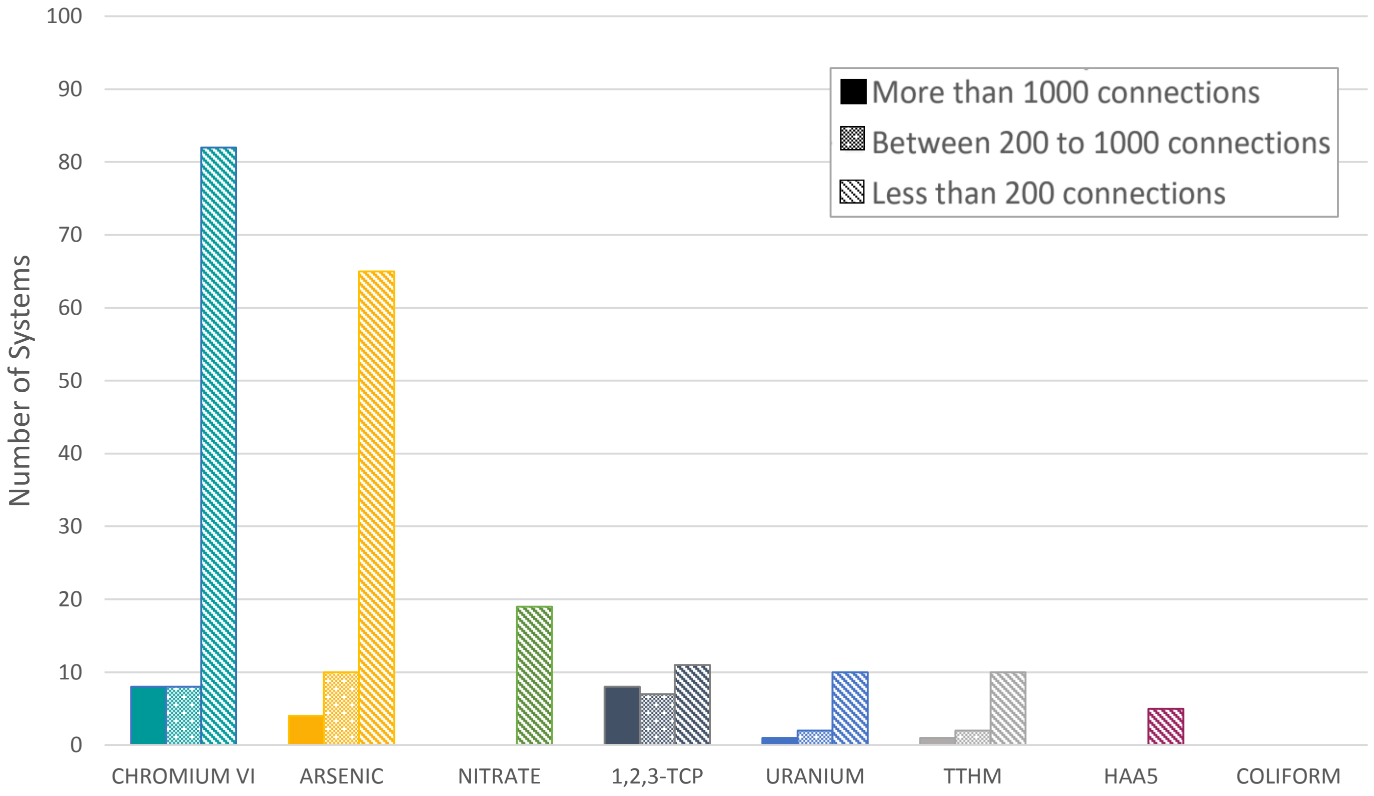
Persistent violation = Health-based violation in at least 12 of the last 20 quarters (2013-2017).

Contaminant	Population Affected	# of Systems
1,2,3-TCP	**64,400**	**26**
Arsenic	**48,900**	**79**
Total Trihalomethanes (TTHM)	21,100	13
Uranium	8,600	13
Nitrate	3,000	19
Other	2,200	9
TOTAL	**137,500**[1]	
Chromium VI	91,600[2]	98

1

IDENTIFY WHICH SYSTEMS TO ADDRESS FIRST

Target the **greatest population** for immediate progress



Populations affected by persistent violations are concentrated (~80%) in systems with ≥200 service connections. The smallest systems (<200 service connections) represent the greatest number of persistent violations, which will likely require higher per capita investments.

	#of Systems[1] with persistent violations	Population Served
At least 200 connections	33	111,700
Less than 200 connections	117	25,800
All small systems[2]	**150**	**137,500**

[1] Some systems affected by multiple contaminants
[2] Chromium VI is not included in the total.

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Take advantage of geographic proximity to address other systems in need

- The phased approach serves as a starting point on where to focus efforts, acknowledging that some systems may require more creative solutions.
- While addressing the high-priority areas, assess whether there are nearby systems in need. Simultaneous consideration of adjacent systems to these areas may provide opportunities for economies of scale and collaboration on common solutions.
- Addressing groups of systems will achieve more timely progress than dealing with systems one by one.

Relevance to other work

The Water Foundation/Blue Sky Consulting Group: 2017 Safe Drinking Water Needs Assessment, July 2017

- Focused on systems with multiple violations (2012-2017)
- Includes very small systems (serving less than 15 people) and those using domestic wells
- Analysis focused on Nitrate vs. non-Nitrate contamination

CUWA's Accessibility Issue Brief, August 2018

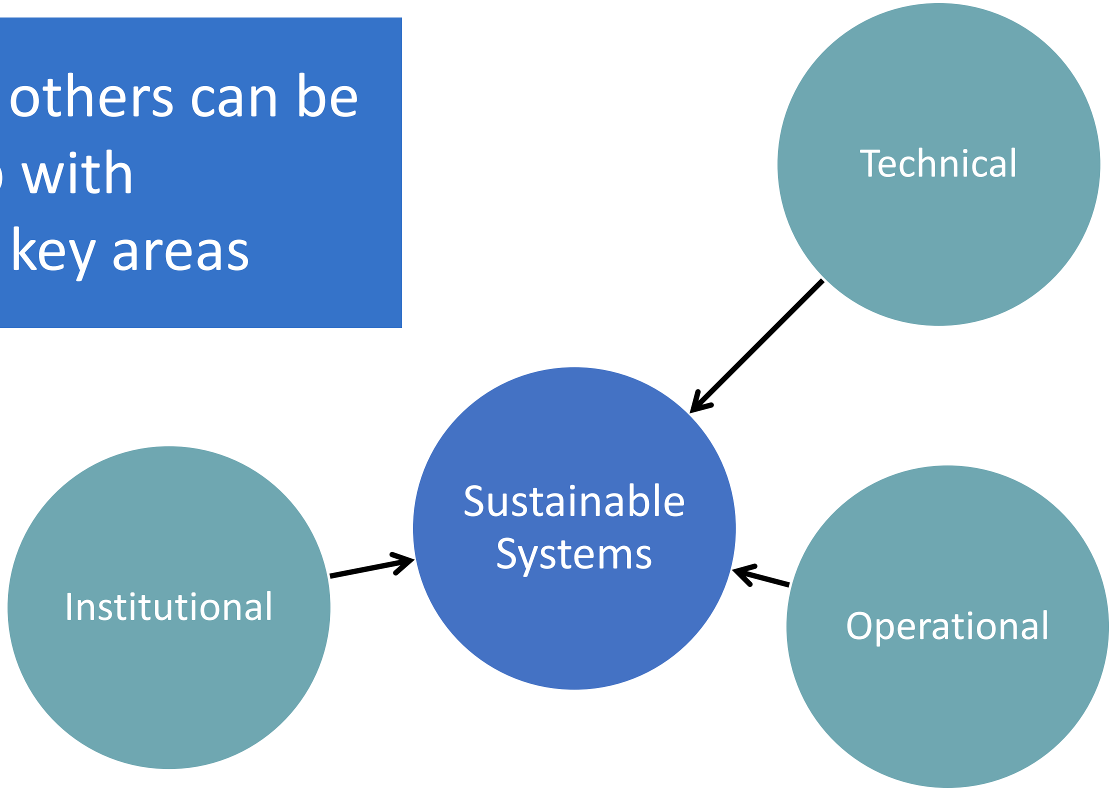
- Focused on systems with persistent violations (violations in 12 out of 20 quarters, 2013-2017).
- Analysis looked at all contaminants with persistent violations; over ¾ of population affected were affected primarily by 1,2,3-TCP or Arsenic.

2 DEVELOP A STRATEGY TO ACHIEVE COMPLIANCE

Enable systems to remain in compliance

Ongoing work by others can be leveraged to help with progress in three key areas

Assess range of capital costs needed to address systems with persistent treatment violations; fully leverage existing sources of funding; explore new cost-effective technologies



Seek opportunities for regionalization/ consolidation to create economically viable sustainable systems.

Assess range of O&M costs for systems and leverage expertise of others; address ability to pay for ongoing activity without permanent reliance on an outside funding source.

Institutional solutions: Definitions

Institutional arrangements:

- **Regionalized** = Several small systems giving up local management and forming a new regional entity
- **Consolidated** = Small systems giving up local management to a larger proximate utility

Physical Connections:

- **Separate systems** = Systems that are stand-alone (could be institutionally regionalized and still remain physically separate)
- **Connected systems** = Systems within reasonable proximity connected via infrastructure

Assessing treatment capital and O&M costs

CUWA estimated planning-level costs for treatment to address persistent violations based on the following:

- Focused on the most pervasive, persistent contaminants that affected the highest population – (1,2,3-TCP, Arsenic, and Chromium VI)
- Utilized existing sources and models for estimating treatment and O&M costs, particularly evaluations that focused on small systems.
- Examined costs for both separate and connected systems

Assessing treatment capital and O&M costs: Assumptions

1,2,3-TCP

- Granular Activated Carbon (GAC)
- SWRCB cost estimation methodology and cost tables for 1,2,3-TCP, Feb 2017
  - Cost estimate model developed by the U.S. EPA using GAC (US EPA, Office of Water, Office of Groundwater & Drinking Water, "Work Breakdown Structure Model for Granular Activated Carbon Treatment", August 12, 2014).
  - ***New MCL as of Jan 2018; limited data set to date.***
  - O&M costs included

Arsenic

- Iron Removal- Coagulation / Filtration (Greensand)
- Costs of Arsenic removal technologies for small water systems: U.S. EPA Arsenic Removal Technology Demonstration Program, 2011
  - No cost assumptions are stated; this document is a compilation of existing costs, with costs curves roughly applied to the actual data fits.
  - O&M costs included

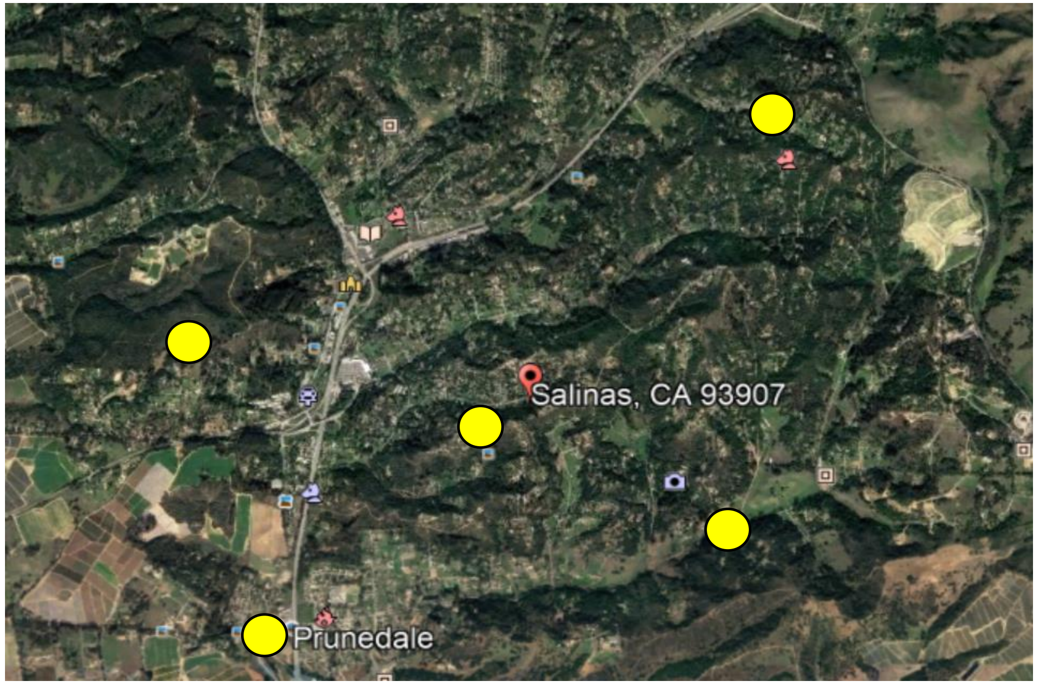
Chromium VI

- Strong Base Anion (SBA) single use resin
- Bench-Scale Evaluation of Alternative Cr(VI) Removal Options for Small Systems; WRF #4561
  - Cost tool limited to systems 200 gpm-1600 gpm in size, extrapolated cost curve for systems <200 gpm capacity
  - No current MCL, but costs included in case an MCL is established
- O&M costs included

Assessing treatment capital and O&M costs: Assumptions (continued)

- Capital and O&M costs were based on flow rate; CUWA assumed a constant flow rate of 150 gpcd, per the assumption in the SWRCB cost estimation methodology for 1,2,3-TCP.
- Capital costs were adjusted to 2017 dollars based on the ENR Construction Cost Index.
- Total present worth was calculated using both capital costs and O&M costs; assumes 6% interest rate and a 20 year period (based on default assumptions in *Bench-Scale Evaluation of Alternative Cr(VI) Removal Options for Small Systems*). Note: Some funding sources, such as State Revolving Fund (SRF) loans, may be available at lower interest rates.
- Annual inflation rate of 2.5% for O&M costs was used, based on the *Arsenic Treatment Technology Handbook for Small Systems, 2003*, page 57.
- Annual O&M costs per household calculated using population in each system, assuming 2.9 people per household (based on 2010 census data for California).

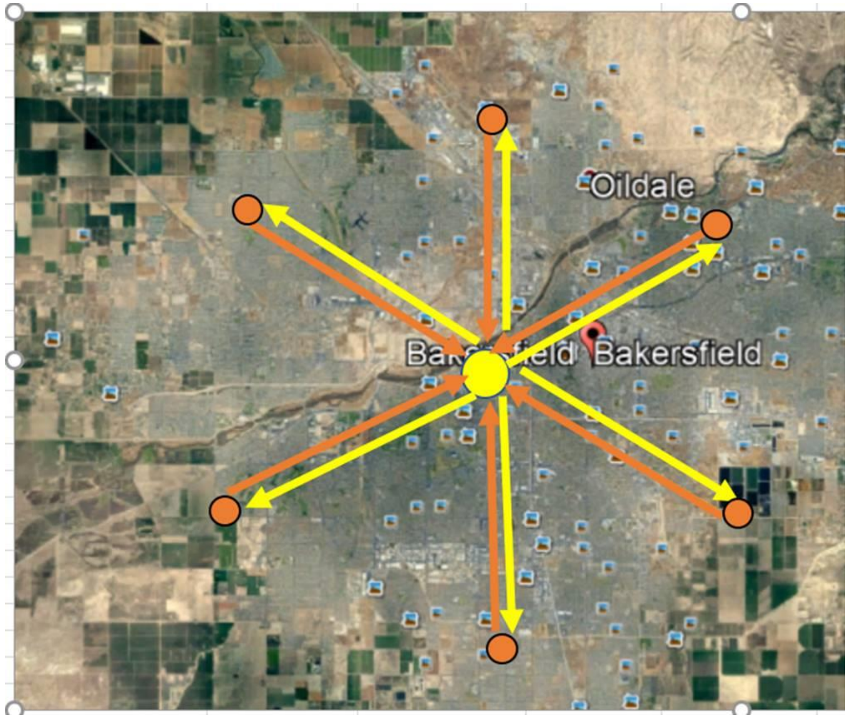
Example: Separate treatment systems



Example consolidation of separate systems

- Five systems exceeding a given MCL in at least 12 out of 20 quarters
- Salinas (93907)
- Specific system locations not known
- Treatment at individual system locations
- Although treatment is separate, systems may still be institutionally consolidated (i.e. the systems give up local management)

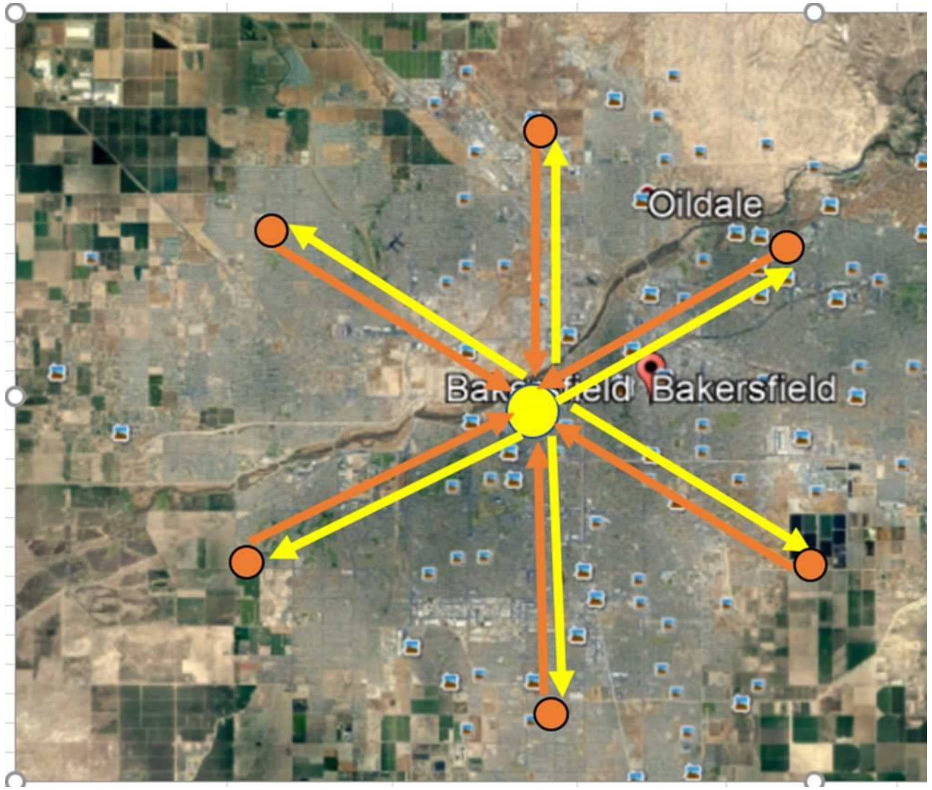
Example: Physically connected system



Example connected systems

- Six systems violating a given MCL in at least 12 out of 20 quarters
- City of Bakersfield
- Specific system locations not known
- Assume within 5 straight miles of centralized treatment facility
- Piping from individual system to regional (orange)
- Return piping from central treatment to individual systems (yellow)

Physically connected system – Infrastructure assumptions



Raw and treated transmission pipe cost estimate assumptions

- Material: ductile iron pipe
- Open cut only; no major jack and bore or other specialized crossing (railroad, bridge, waterway, etc.)
- Existing right of way; no land acquisition needed
- Tie back into existing raw water and distribution systems (does not account for connecting multiple groundwater pumps; no additional work such as piping or meters at each connection/ residence)
- Maximum pipe velocity of 5 fps
- No additional pump stations included

Based on **2007 Drinking Water Infrastructure Needs Survey and Assessment: Modeling the Cost of Infrastructure**

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2 DEVELOP A STRATEGY TO ACHIEVE COMPLIANCE

Treatment and O&M costs

SEPARATE TREATMENT FACILITIES (NOT PHYSICALLY CONNECTED)

Contaminant	Treatment Capital Costs ($M)	Annual O&M Costs ($M)	Total Present Worth ($M)	Total Present Worth per Capita ($)	Monthly O&M Cost per Household ($)
1,2,3-TCP	8.4	1.4	24	370	5
Arsenic	8.5	1.2	23	460	6
Chromium VI	*104*	*25*	*390*	*4,300*	*66*
TOTALS (without CrVI)	**16.8**	**2.6**	**47**	**410***	**6***

CONNECTED SYSTEMS WITH CENTRALIZED TREATMENT FACILITIES

Contaminant	Treatment Capital Costs ($M)	Piping Capital Costs ($M)	Total Capital Costs ($M)	Annual O&M Costs ($M)	Total Present Worth ($M)	Total Present Worth Cost per capita ($)
1,2,3-TCP	8.2	22	30	1.3	45	700
Arsenic	7.7	302	310	1.2	324	6,600
Chromium VI	*55*	*528*	*583*	*17*	*774*	*8,400*
TOTALS (without CrVI)	**15.9**	**324**	**340**	**2.5**	**368**	**3,251***

*Weighted average

Notes:

- Some systems are affected by two contaminants, so total costs may be overly conservative
- Pipe O&M costs not included

Conclusion: Physical connection to centralized treatment systems may be prohibitively expensive

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Relevance to other work

Small System Water Authority (SSWA) Act 2018 (AB2050), Overview of Supporting Funding Model

- Institutional focus
- Creation of SSWAs in a County that has at least 5 systems out of compliance (any MCL violation)
- 15 Counties, 27 SSWAs
- Administrative costs only

UC Davis Center for Regional Change
The Struggle for Water Justice in California's San Joaquin Valley: A Focus on Disadvantaged Unincorporated Communities (DUCs), Feb 2018

- Spatial focus
- Spatial analysis of DUCs and locations with respect to Community Water Systems (CWSs)
- Focused on institutional solutions such as connecting DUCs to nearby CWS via voluntary or state-mandated consolidations, and financial incentives
- Consolidate based on distance to nearest CWS boundary:
    - Within 500 feet
    - Within 1 mile
    - Within 3 miles
    - Beyond 3 miles
- Does not account for sustainability of nearest CWS

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- Technical focus
- Focused on systems with persistent violations (violations in 12 out of 20 quarters, 2013-2017).
- Of persistent violations, identified greatest population affected by contaminants (over ¾ of population affected by 1,2,3-TCP or Arsenic)
- Connected systems if in same County and within 5 straight miles (based on zip code)
- No detailed spatial analysis

New systems must have adequate TMF capacity for long-term operations

- **Prevent new failures with more rigorous requirements.** Despite the recent “stop the bleeding” legislation limiting permitting of new unsustainable public water systems, many new development projects continue without appropriate TMF capacity, continuing the cycle of failing systems. It is critical that any new systems comply with existing requirements and have the flexibility to adapt to future needs.
- **Develop with the future in mind.** Encourage stronger coordination with land use planning authorities, Groundwater Sustainability Agencies (GSAs), and the Division of Drinking Water (DDW) on the formation of future water systems. Coordination with these agencies should occur early in the planning process to promote a shared understanding.

INCREASED STATE LEADERSHIP CAN PRODUCE RESULTS

- **Make existing funding more easily available** now to systems with persistent health-based violations. Timely funding of needed improvements, especially to those systems already identified as needing assistance, can expedite progress in providing safe water.
- **Improve practices** to address violations that are more operational in nature, through optimization, rehabilitation, or new institutional structures. Solutions may not always require new treatment processes.
- **Explore more cost-effective, sustainable solutions** particularly those that can be customized or scaled to meet various needs, such as prefabricated treatment systems. A number of manufacturers are developing units that have the potential to improve water quality cost effectively.
- **Fully leverage existing sources of funding** and ensure that systems receiving external capital and O&M funding are on a path to become self-sustaining, as State-provided funds sunset over time. Existing support is a springboard for change rather than an immediate band-aid that requires continual support for ongoing funding.