

January 11, 2023

Bay Area Supply Chain Resilience Seminar Series

Bay Area Commodity Flows – Validated Findings FOOD and WATER



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<http://www.bayareauasi.org/sites/default/files/resources/Bay%20Area%20UASI%20FY2019-2019%20Annual%20Report%20Website.pdf>

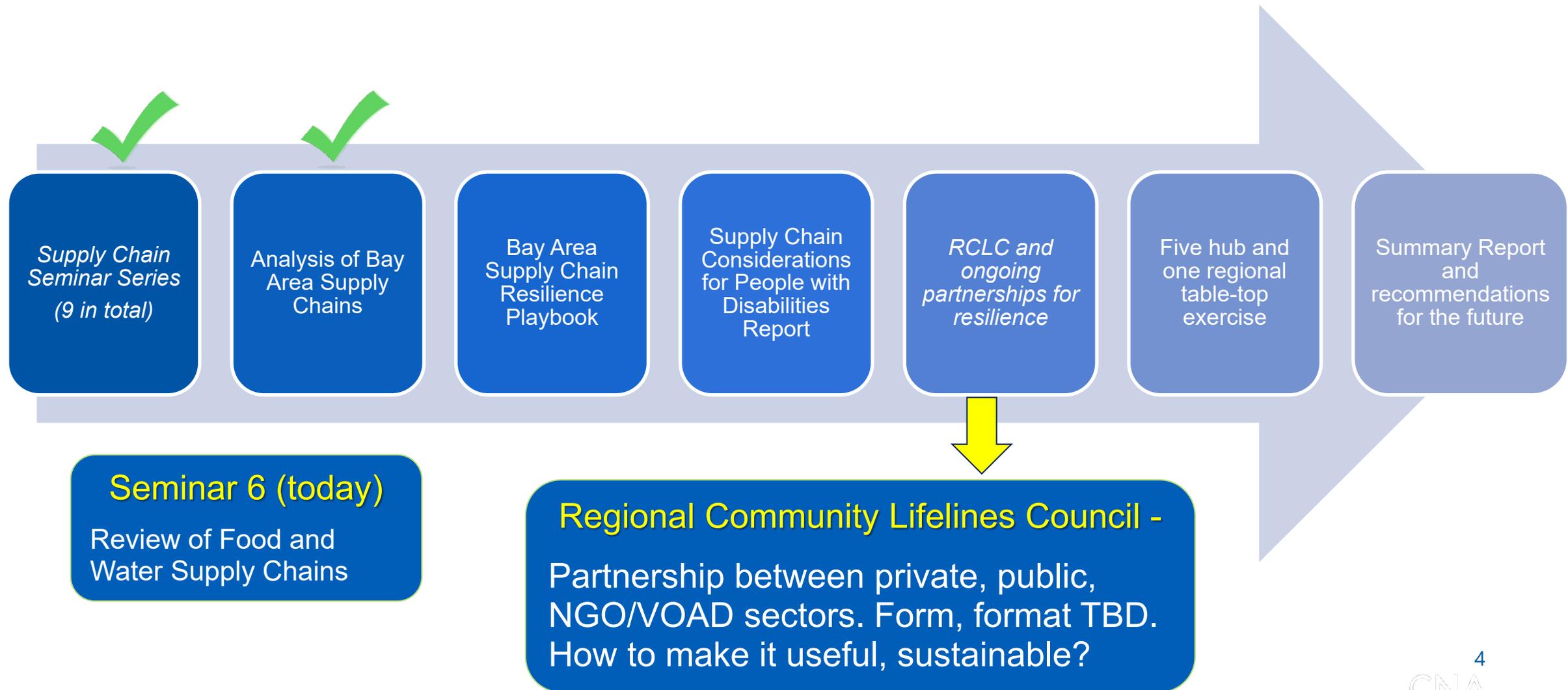
Agenda

- Introduction
 - Welcome and Introductions
 - What is the Bay Area RCPGP Supply Chain Resilience Grant?
 - How we got here – previous seminar summary
- **Module I:** Bay Area Food Flows
- **Module II:** Bay Area Water System Flows
- **Module III:** Synthesis and Emergency Management Roles during disasters
- Wrap-Up and Next Steps

Regional Catastrophic Preparedness Grant Program (RCPGP)

- The purpose of the Bay Area's RCPGP Supply Chain Resilience project is to:
 - Improve public/private partnership coordination capabilities for disaster response by enabling the private sector to reconstitute supply chains as rapidly as possible following a disaster.
 - Reduce the impacts of supply chain disruptions on vulnerable populations through the development of guidance and materials to support critical path decision-making and awareness of how people with disabilities in the Bay Area access groceries and food.

What will the Bay Area RCPGP Supply Chain Resilience Grant Produce



Review – Seminars 1 - 5

Prior seminars you were invited to:

Seminar 1: **Supply chain fundamentals**

Seminar 2: **Supply chain fundamentals – part 2**

Seminar 5: **Supply chains during disasters**

Preliminary analysis validations with private (and water) sector partners:

Seminar 3: **Bay Area Commodity Flows: Food**

Seminar 4: **Bay Area Commodity Flows: Water**

Seminar 6: **Bay Area Commodity Flows Summary**
(post-validation)

Welcome & Introductions

Introduce Yourself in the Chat:

- Name and Jurisdiction/Agency (Organization)

Meeting Logistics

- This meeting is being recorded
- Please ensure you're muted during the presentation
 - *6 to mute/unmute on the phone
- Primarily focused on summarizing information; no formal discussion, but it is ok to ask questions for clarification
- Please raise your hand or use the chat to ask a question
 - *9 to raise and lower hand on the phone

Learning objectives

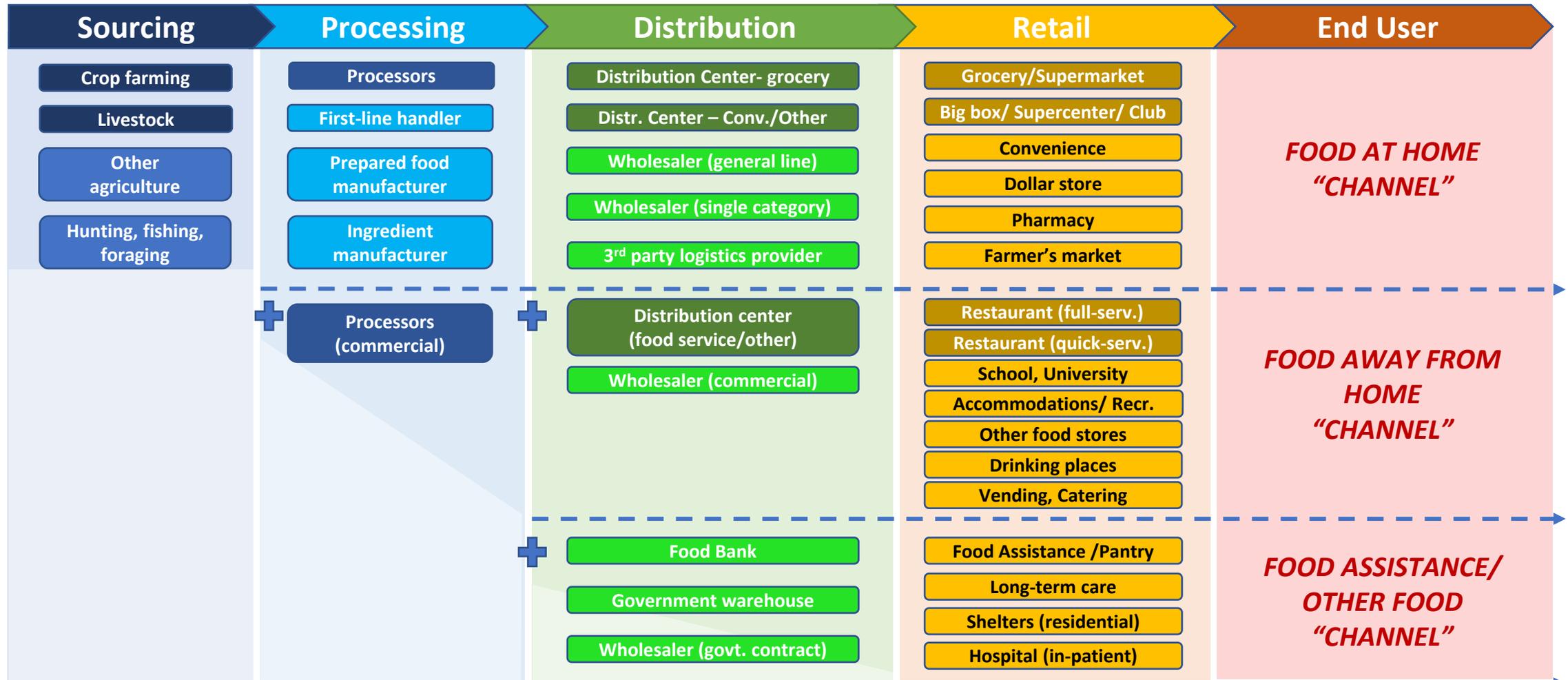
- **Know your region's flows** – Baseline understanding of the major food and water systems/supply chains. High-level picture of the most critical water and food flows for you to understand (as informed, validated by private sector).
- **Know your key players** – Who are the major players in the water and food sectors? Where do they fit in the supply chain?
- **Know what you can do** - What can you do to help restore, augment, or support supply chains and meet population food and water needs?

MODULE 1

Bay Area Commodity Flows: Food

Lifeline Overview – Food and Agriculture

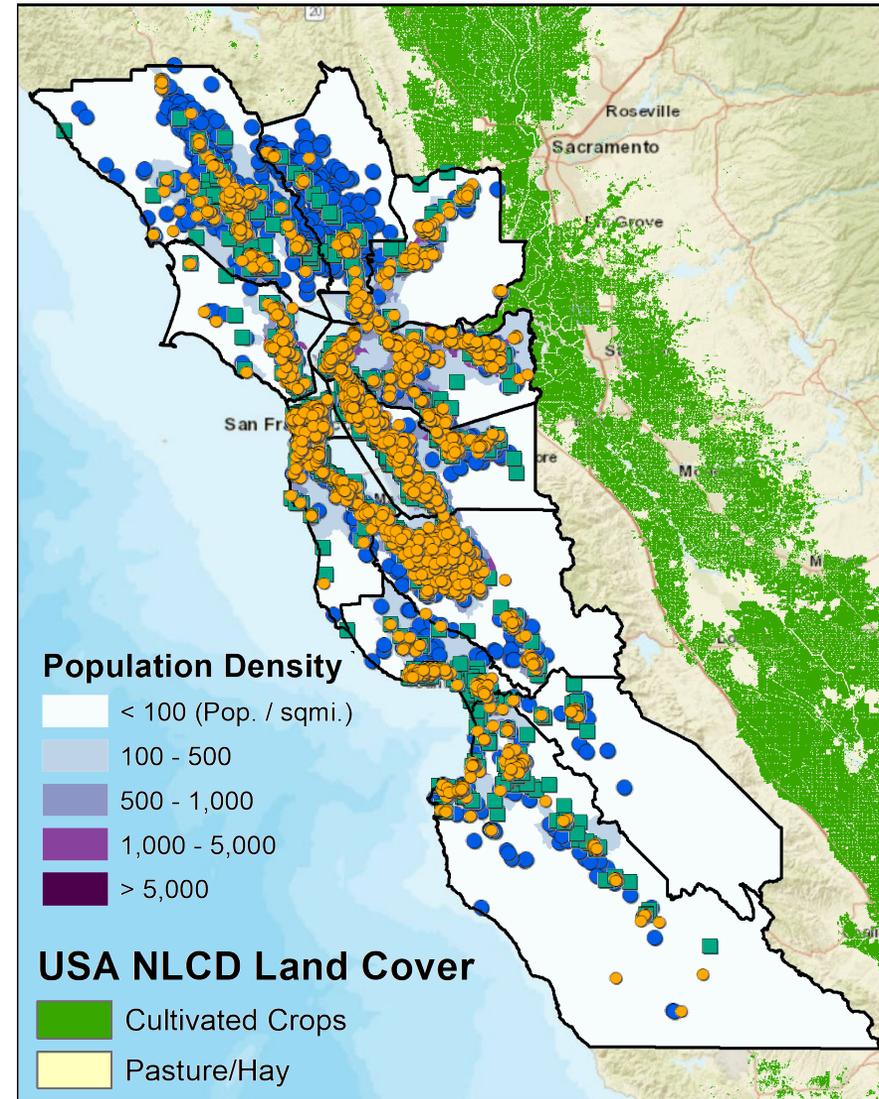
- Supply chain stages, channels, and node types



Supply Chain Stage Overview – Basic Location



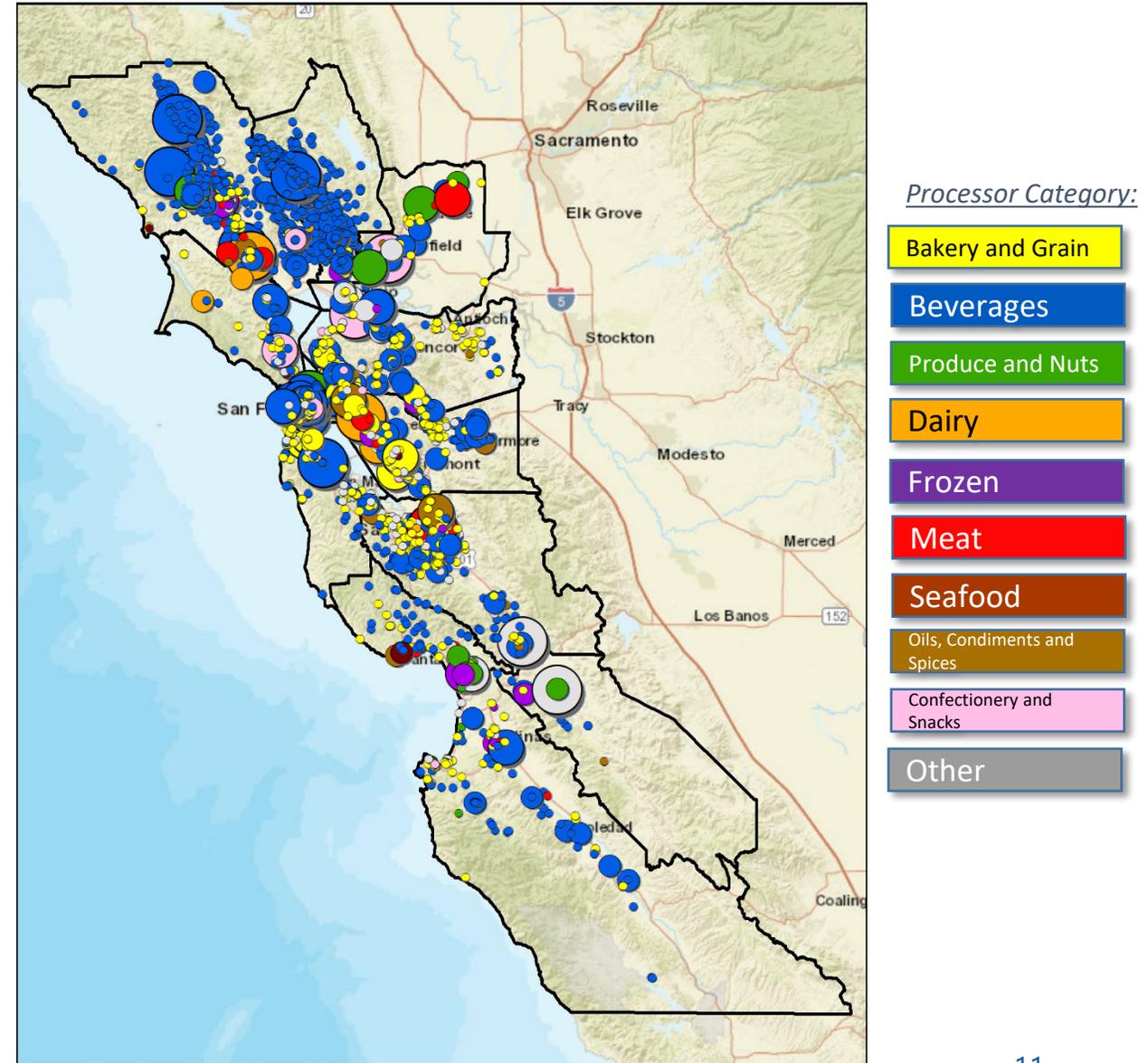
- Locations give the first, limited look at concentrations of activity
- Every supply chain stage likely has some geographic clustering based on proximity to supply sources, consumers, and/or key resources (including transportation)



Data Sources: Data Axle (2022); NLCD (2019); Census Bureau (2018)

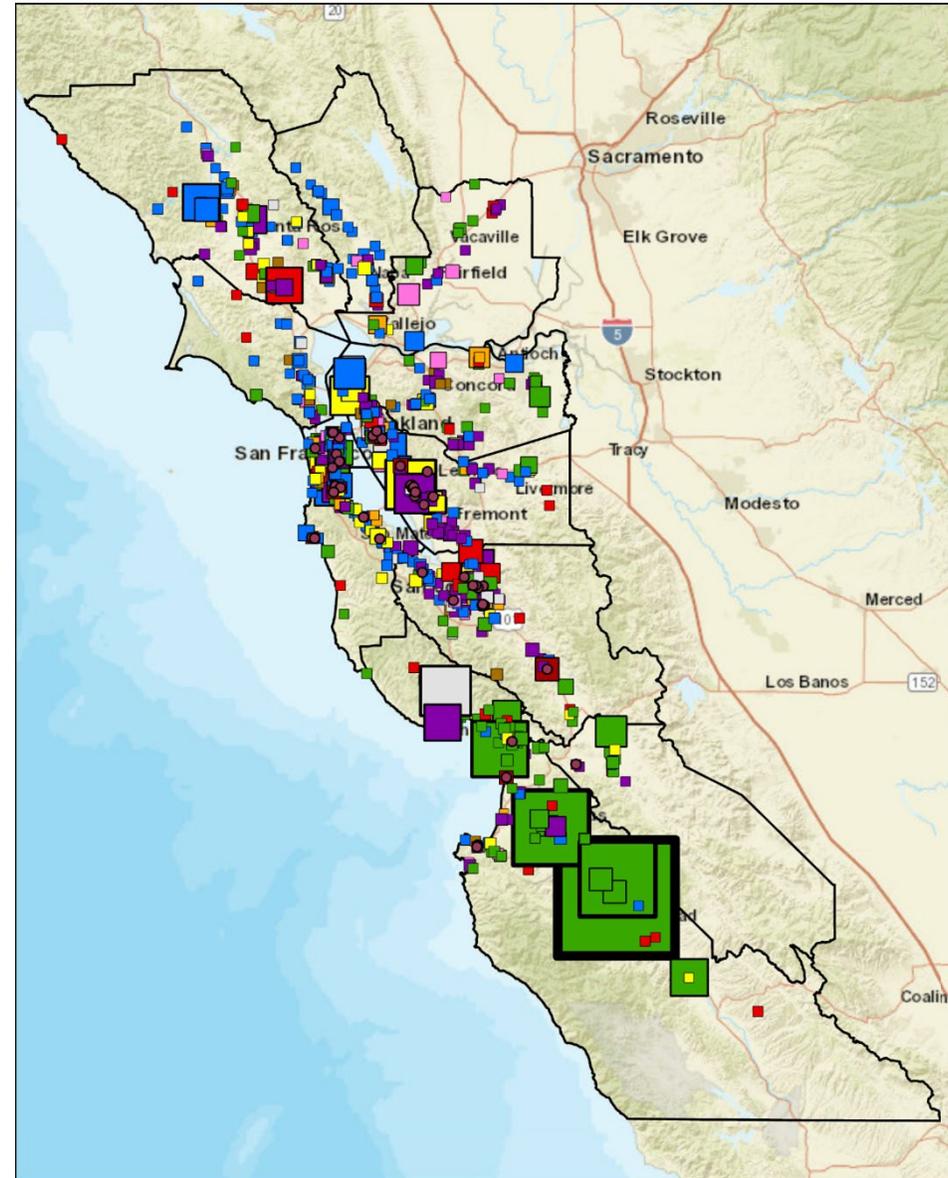
Processing

- Processors concentrated somewhat geographically – depending on commodity – near agricultural areas, near population centers or transportation access
- Categorization by NAICS code can allow view of different commodities
- Geographic patterns emerge by commodity type
 - E.g., beverage processing concentrated in wine regions
- May be missing important processors outside of the region



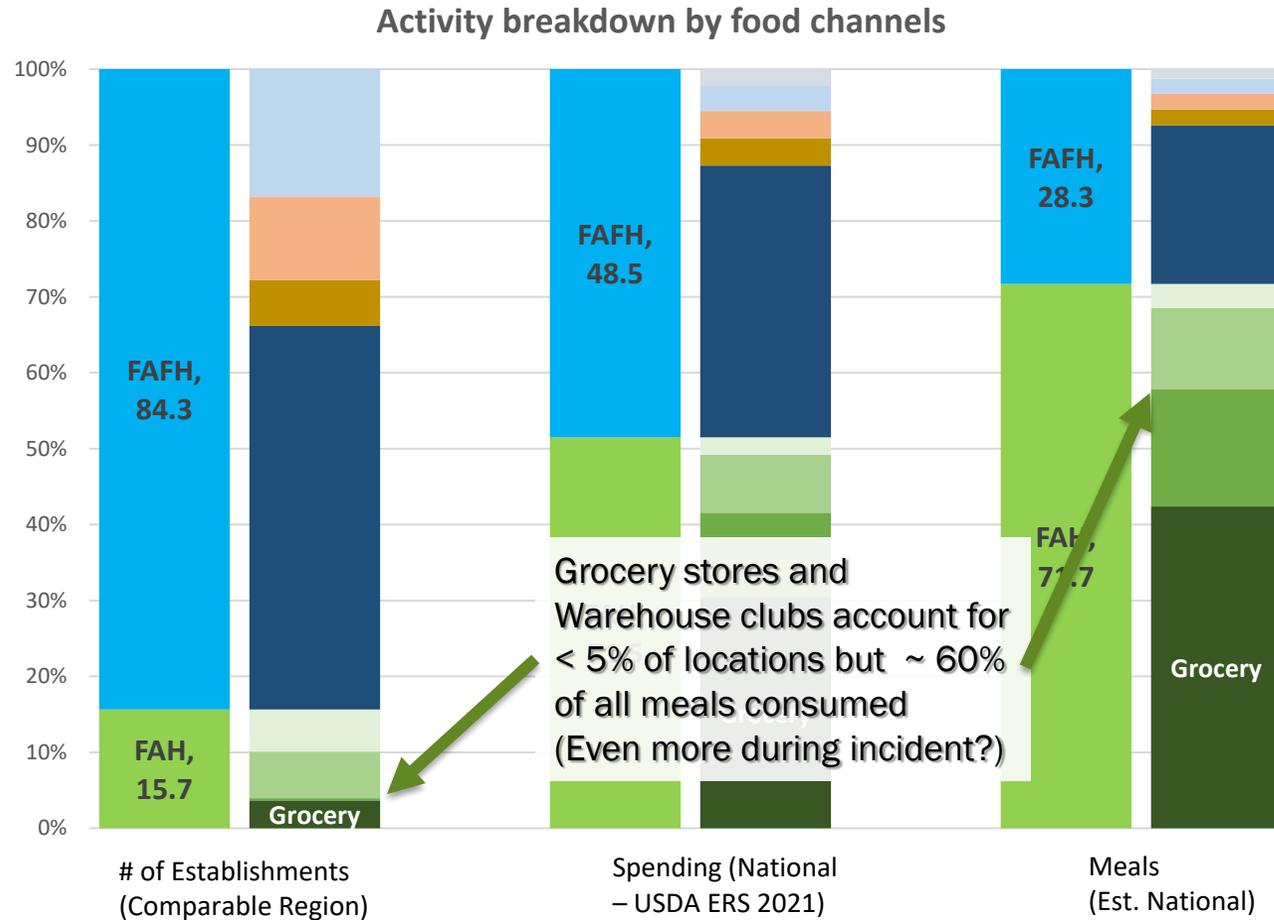
Distribution and Wholesaling

- Some wholesalers specialize in one food commodity, others carry full grocery lines.
- Separating nodes by commodity type helps see spatial patterns
- Some wholesalers may also be processors
- Many more wholesalers may be outside of the region



Why focus on grocery distribution flows?

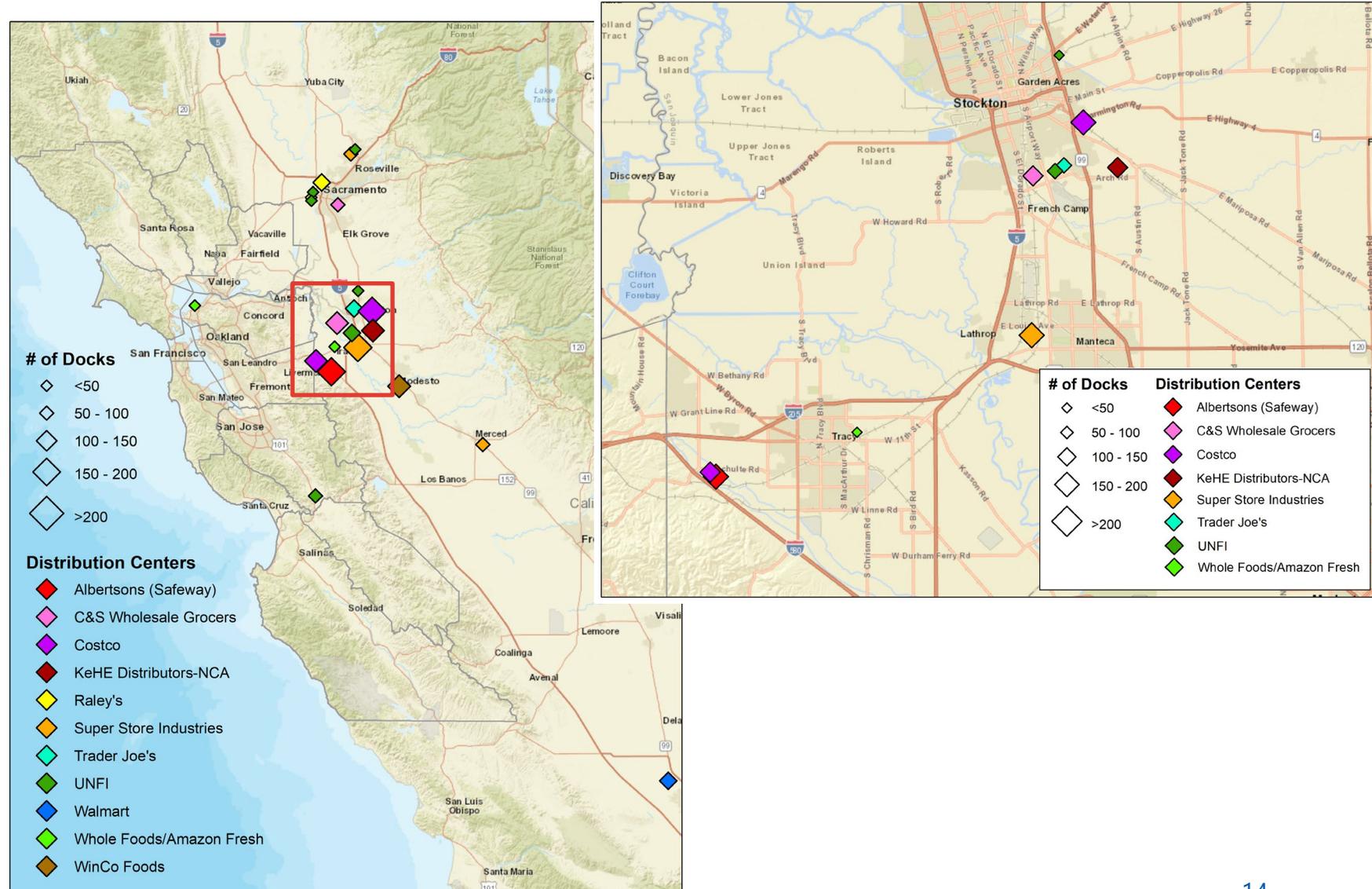
- **Retail channels** for acquiring food are often broken down into Food at Home (FAH) and Food Away from Home (FAFH). Different metrics can lead to different views, but Meals may be the most relevant.



- Consider:**
- Which channels are more likely to shut down during a catastrophic incident?
 - Which must operate?
 - Which are most critical to re-open?
 - Which types of establishments may provide broader access versus greater number of meals?

Distribution Centers

- Large distribution centers are likely the highest flow nodes in the supply chain
- Zooming in we can see one of the more important areas supplying the Bay Area Region (Tracy and Stockton)



Sources: CNA (2022); Various retailer websites, personal communications.

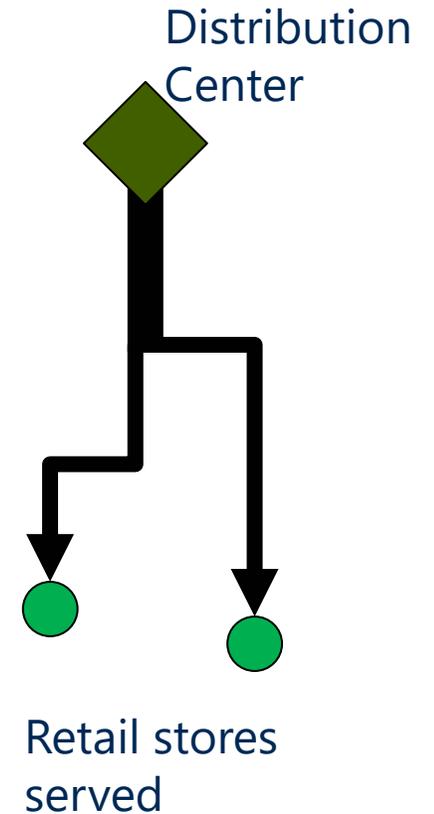
Distribution to Retail – Grocery Market Share and Flow Mapping

Goal: Model routes from distribution centers to retail stores for leading brands and combine in order to visualize cumulative truck flows (by market share).

Grocery Market Share Estimates

Brand / Wholesale Supplier*	Locations served (in BA UASI)	Palin (2019) for BA UASI	Shelby - N. CA & NV (2021)	Calculated (this project – 2022)
Albertson's (Safeway)	183	24-26%	22%	26%
Super Store Industries (Lucky, FoodMaxx, Save Mart)	89	21-23%	5%	10%
C&S Wholesale Grocers*	129	11-13%		5%
UNFI*	70+	11-13%		13%
Walmart	40	10-12%	8-9%	5%
Raley's, Nob Hill	36		6-7%	4%
Costco	30			7%
Trader Joe's	55		4-5%	5%

Total: ~75% of market share



* Wholesale suppliers serving many banners

Distribution to Retail - Key Players by County

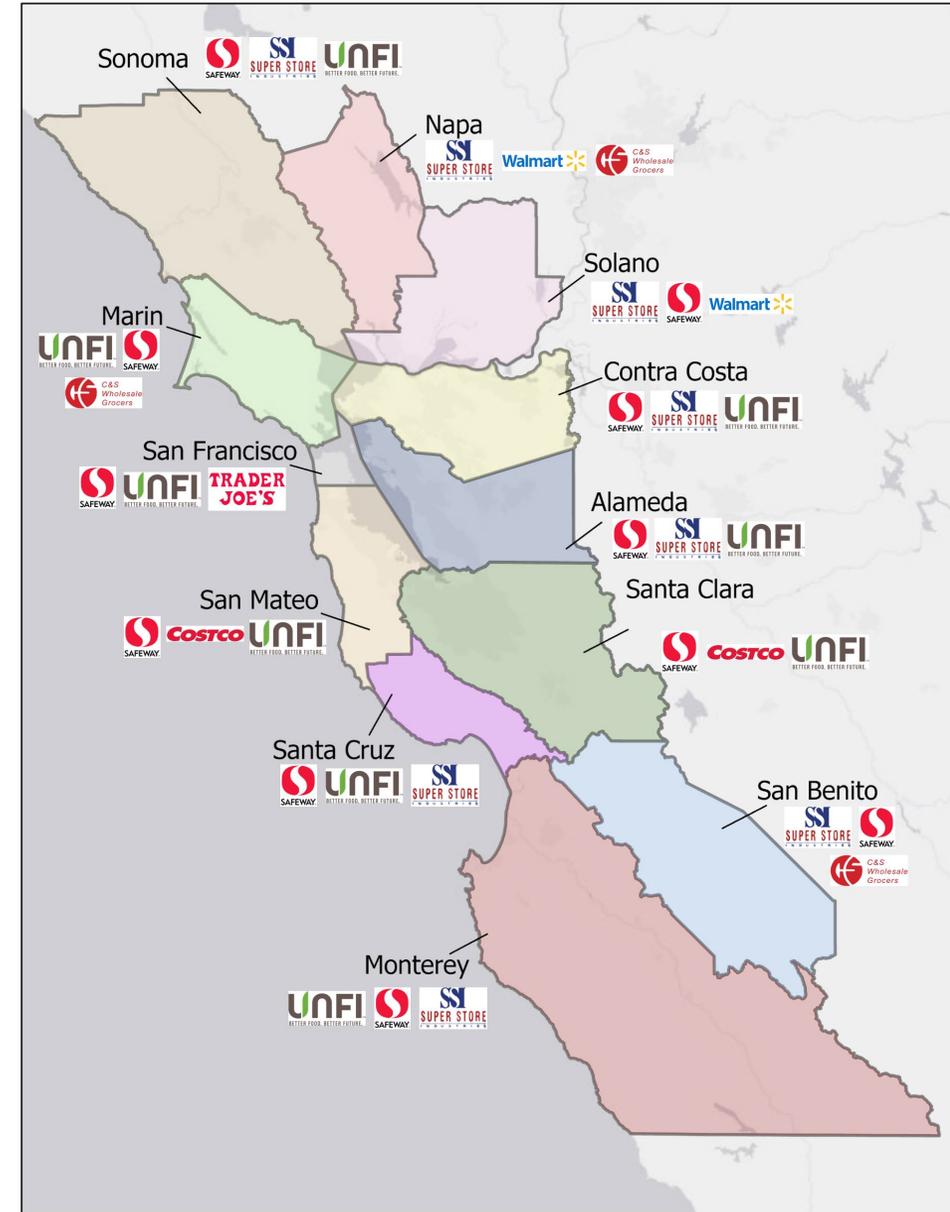
Goal: Know the brand relationships that are important for your jurisdiction

County	Top Brand	2nd Top Brand	3rd Top Brand
Alameda	Safeway	SSI	UNFI
Contra Costa	Safeway	SSI	UNFI
Marin	UNFI	Safeway	C&S
Monterey	UNFI	Safeway	SSI
Napa	SSI	Walmart	C&S
San Benito	SSI	Safeway	C&S
San Francisco	Safeway	UNFI	Trader Joe's
San Mateo	Safeway	Costco	UNFI
Santa Clara	Safeway	Costco	UNFI
Santa Cruz	Safeway	UNFI	SSI
Solano	SSI	Safeway	Walmart
Sonoma	Safeway	SSI	UNFI

SSI brands: Food Maxx, Lucky's, Save Mart.

UNFI-served banners: Whole Foods, Cardenas, Food 4 Less, Foods Co., Lunardi's, independent brands.

C&S-served banners: Target, independent brands.



Distribution to Retail – Flow Overview

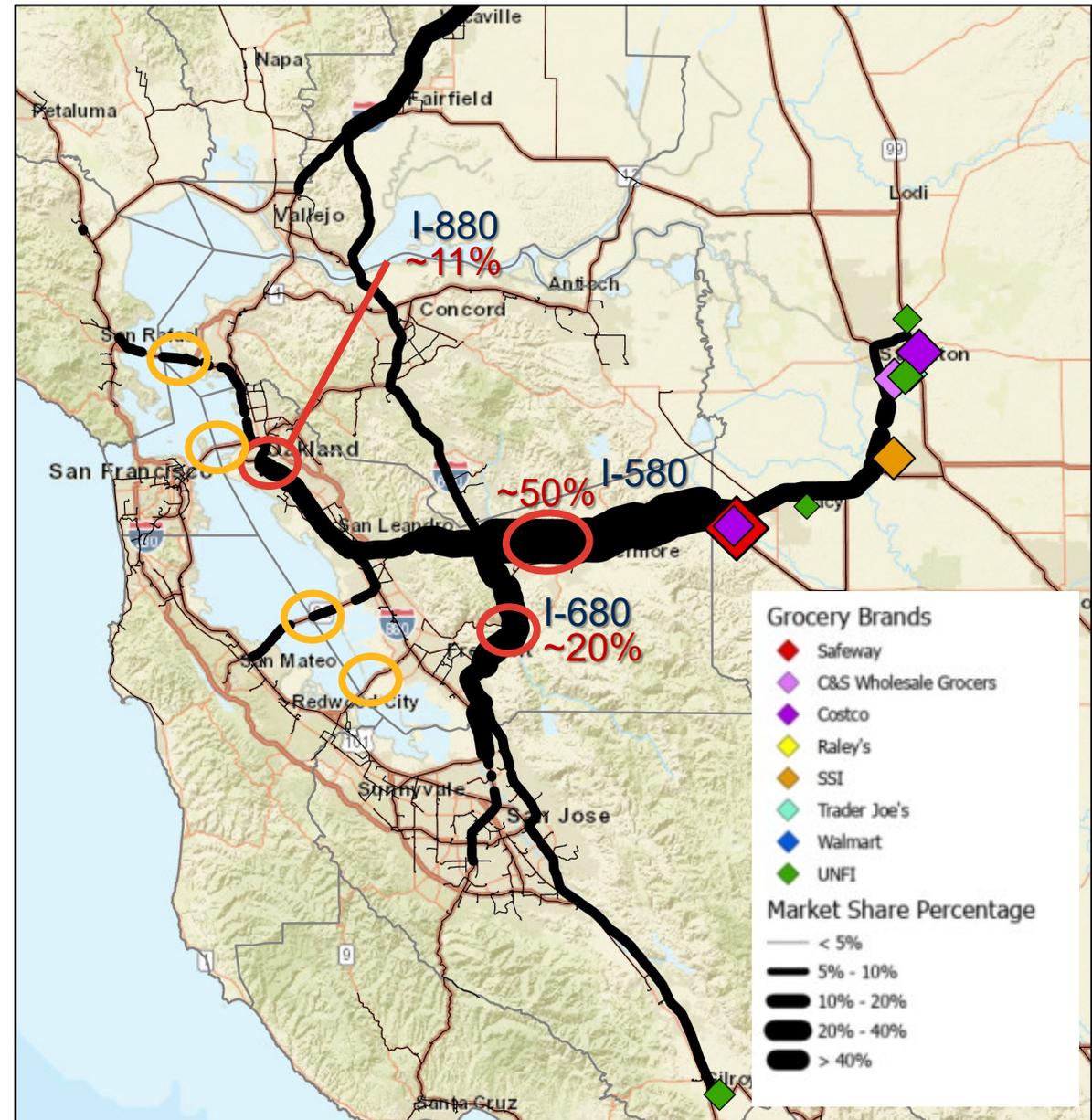
(% of market share *served*)

- Our routing analysis (routing from distribution centers to retail stores) shows concentration of grocery truck flows as a percent of total “market share served” along those routes.
 - Wider lines = more market share served.
- There are two major areas of concentration for distribution centers
 - The Tracy-Stockton area (red square)
 - The Sacramento area (blue square)
- Both areas are outside of the Bay Area region, meaning flows concentrate on a few key truck routes into the area, including I-580 and I-80.



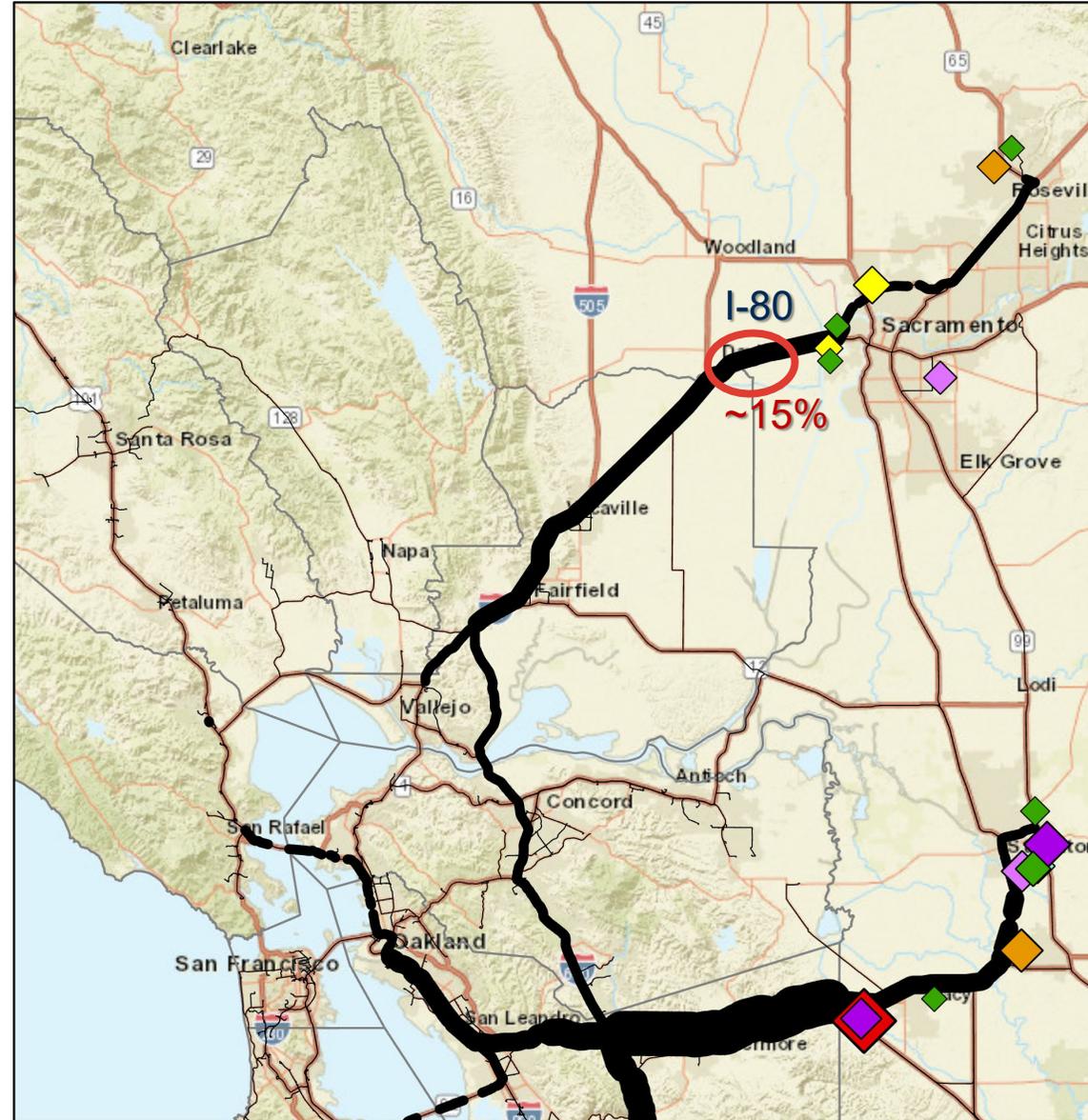
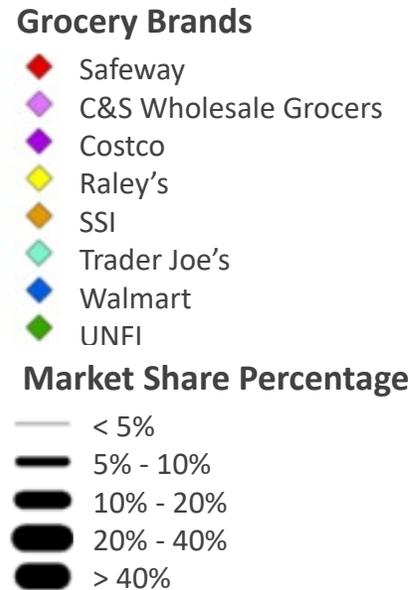
Distribution to Retail – Flow Overview (% of market share served)

- I-580 represents the most important food freight route into the Bay Area.
- Four major bridges for food freight (Yellow circles) carry ~17% of grocery market share. Notable: San Mateo and San Rafael bridge.
- I-680 appears to be an important connector for San Jose; I-880 for Oakland.



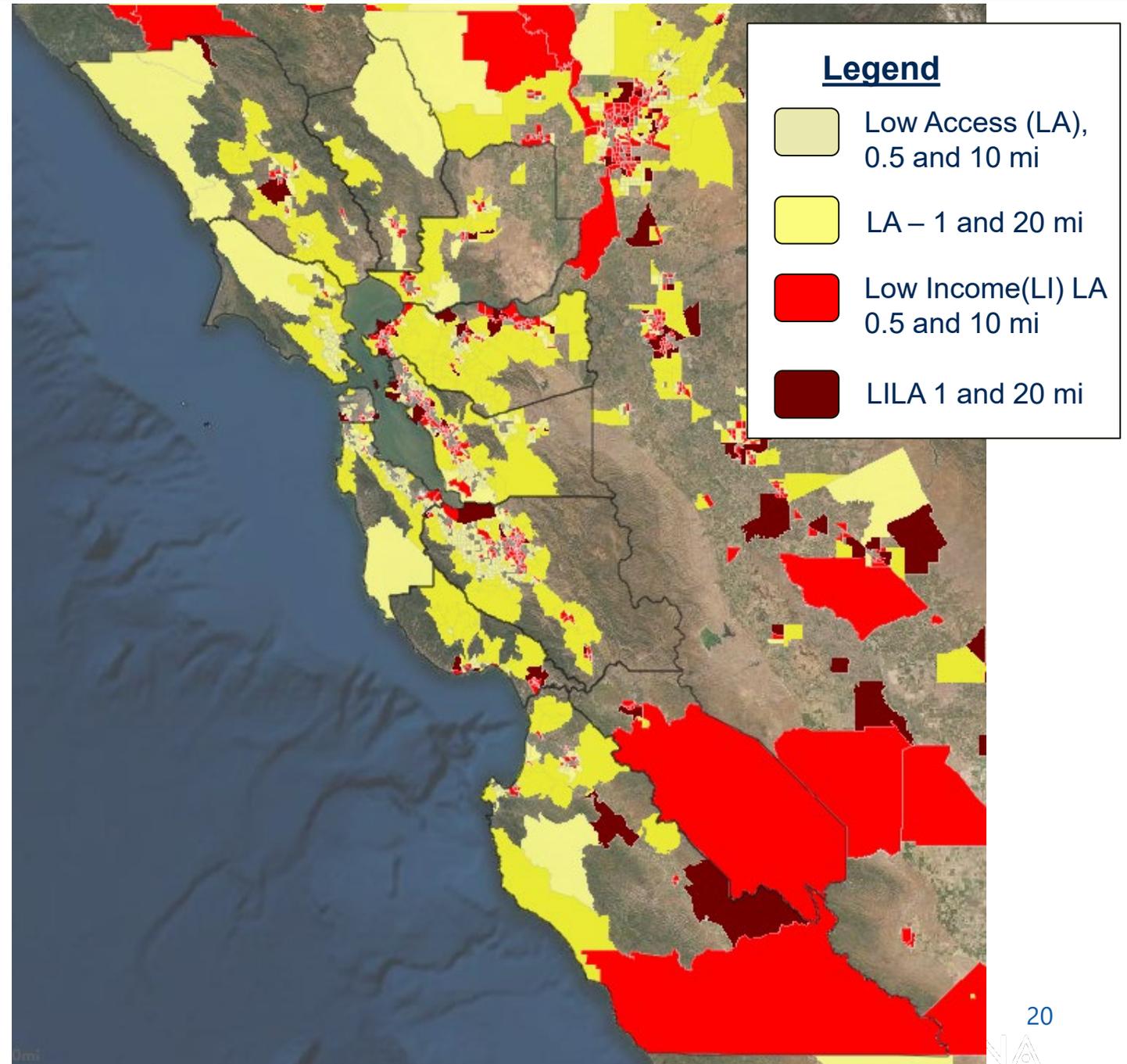
Distribution to Retail – Flow Overview (% of market share served)

- There are a handful of distribution centers based out of Sacramento
 - UNFI, C&S, Raley's, and SSI
- This makes I-80 an important route for northern counties in the region



“Food Deserts” - USDA Food Access Research Atlas (2019)

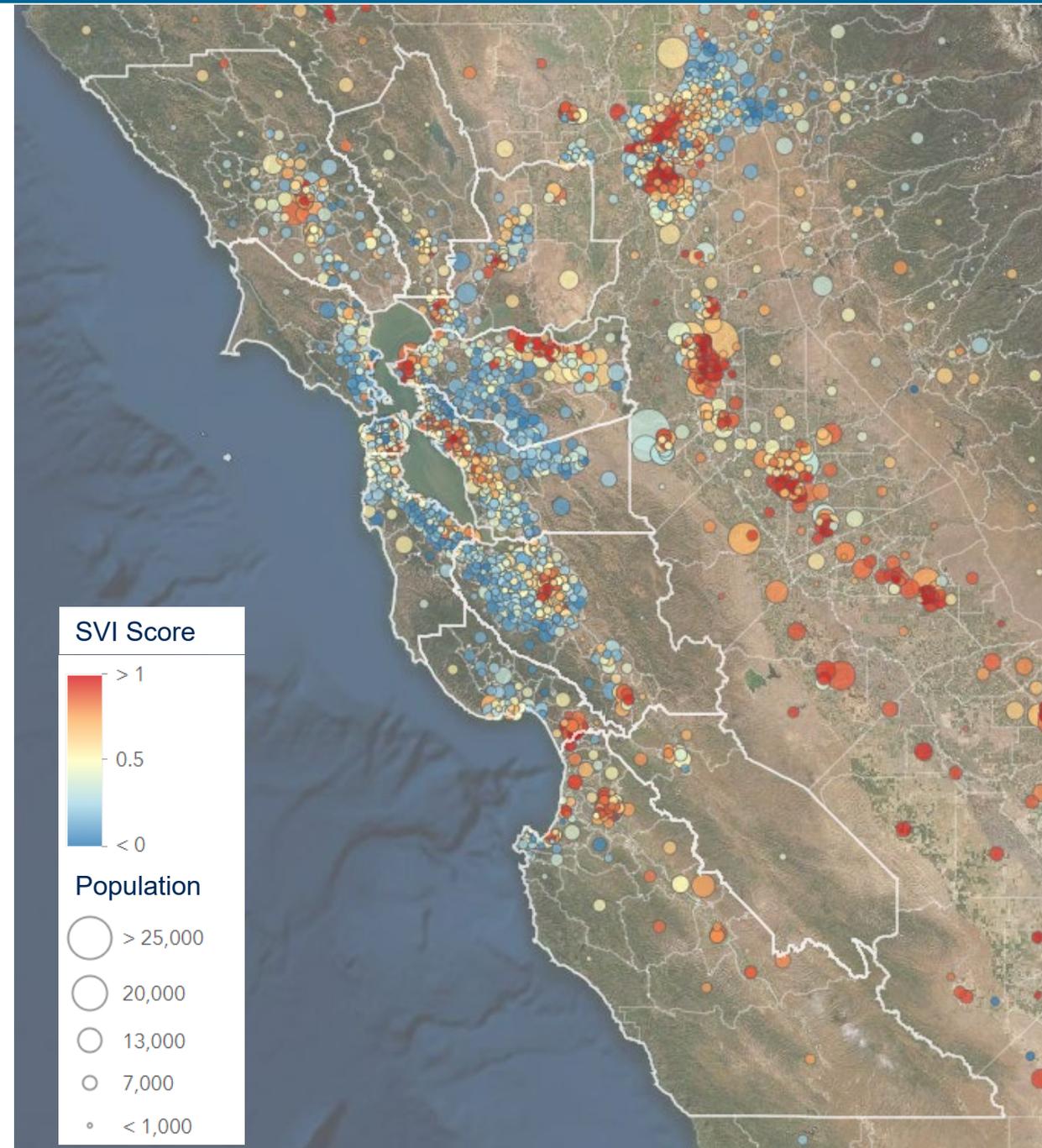
- Tracts with low access to grocery stores at 0.5 or 1 mi (urban areas) and 10 or 20 mi (non-urban areas).
- Areas that are low-income and low access (LILA) merit additional attention
- Source: [USDA ERS](#)



CDC Social Vulnerability Index (SVI)

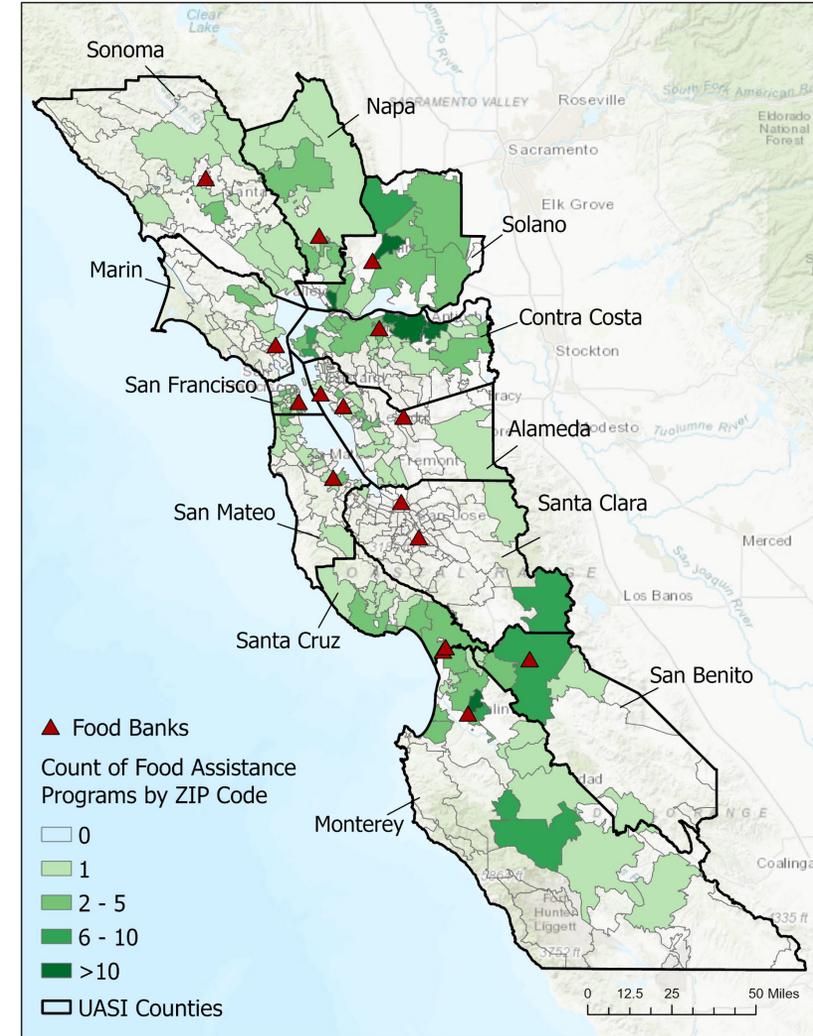
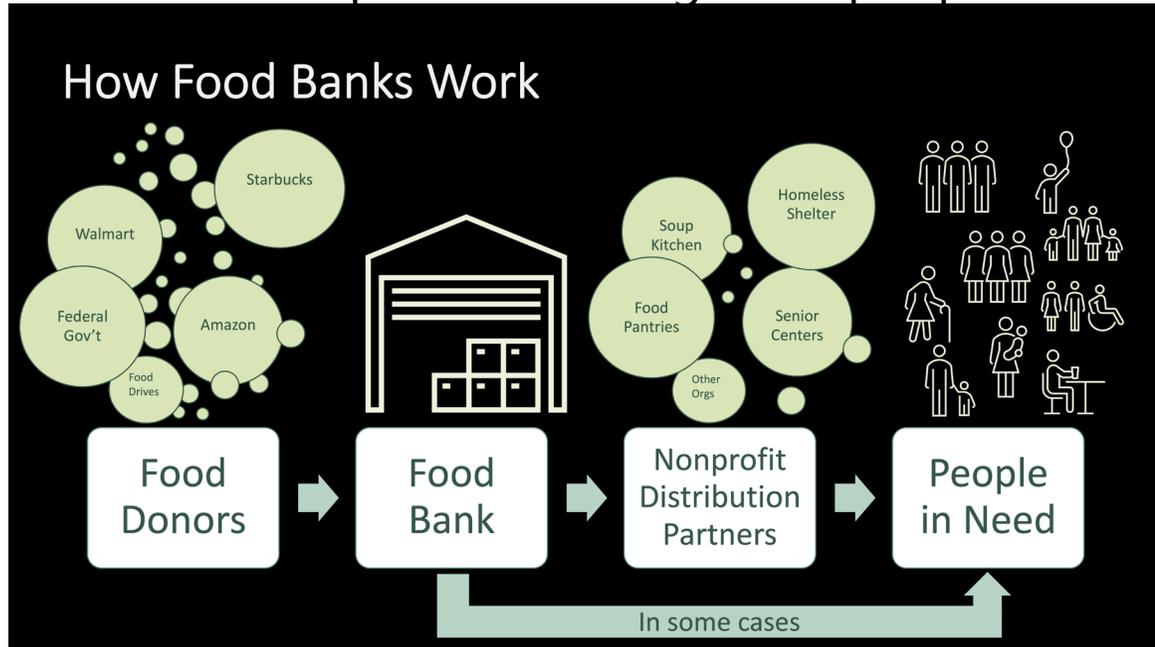
- Commonly used in EM community to identify populations at higher risk.
- Assesses socioeconomic, household composition and disability status, racial and ethnic minorities, and housing and transportation variables combined into *themes*.
- Scored on 0 to 1 scale, higher score = more vulnerable

Source: [CDC](#) (2018)



Other Food Flows – Food Banks and Food Assistance

- Some of the most vulnerable users obtain a significant portion outside of normal retail channels
- Food Banks aggregate food from many sources (corporate donations, food producers, government programs, and purchases) and distribute to food assistance partners who give to people in need.

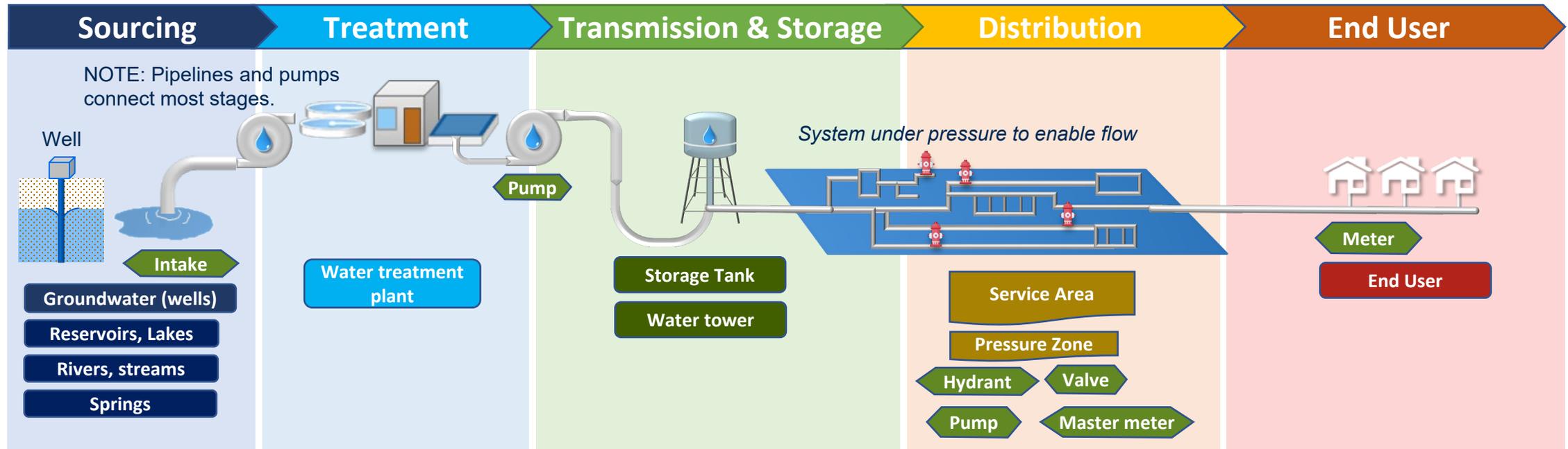


MODULE 2

Bay Area Commodity Flows: Water

Water System Conceptual Overview...

- Water system stages and associated feature types



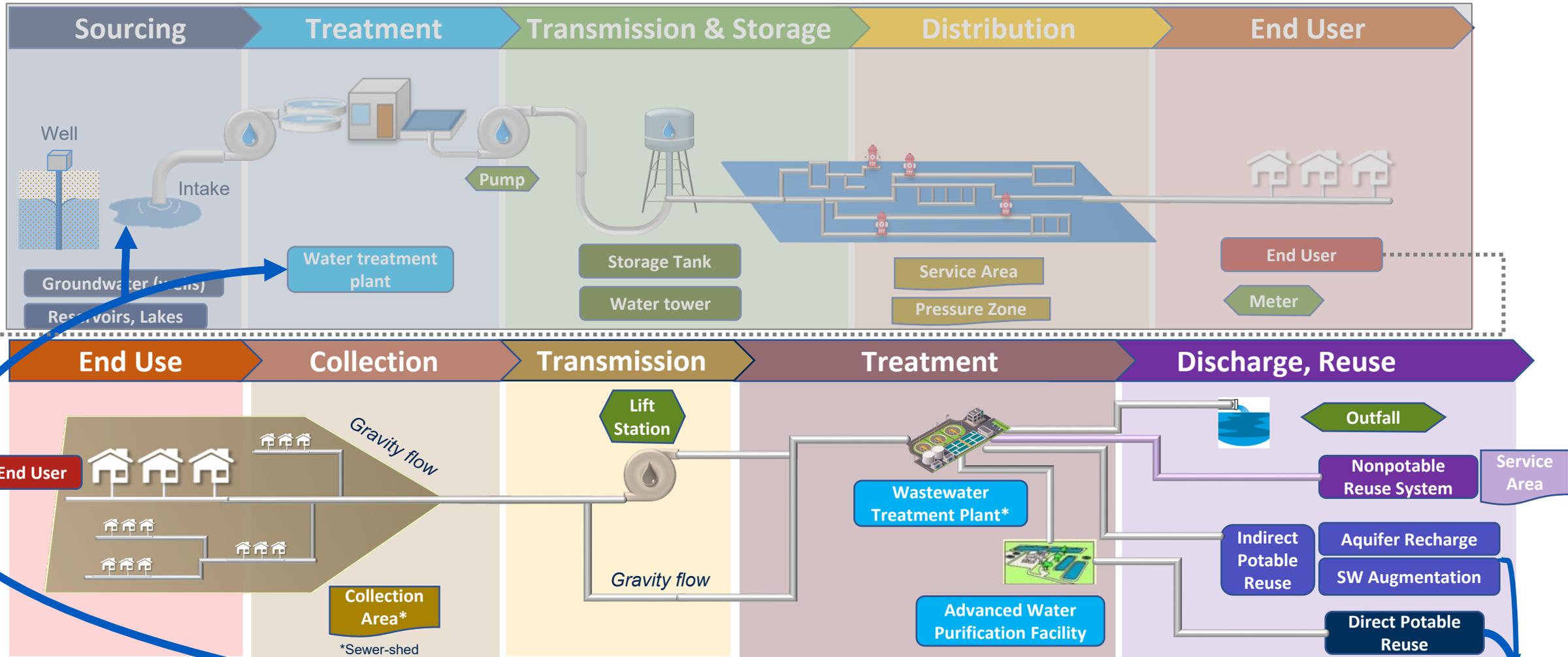
Node Facility with defined location, capable of moving water, and some storage capacity.

Area Geographic area enclosing infrastructure operated by water system

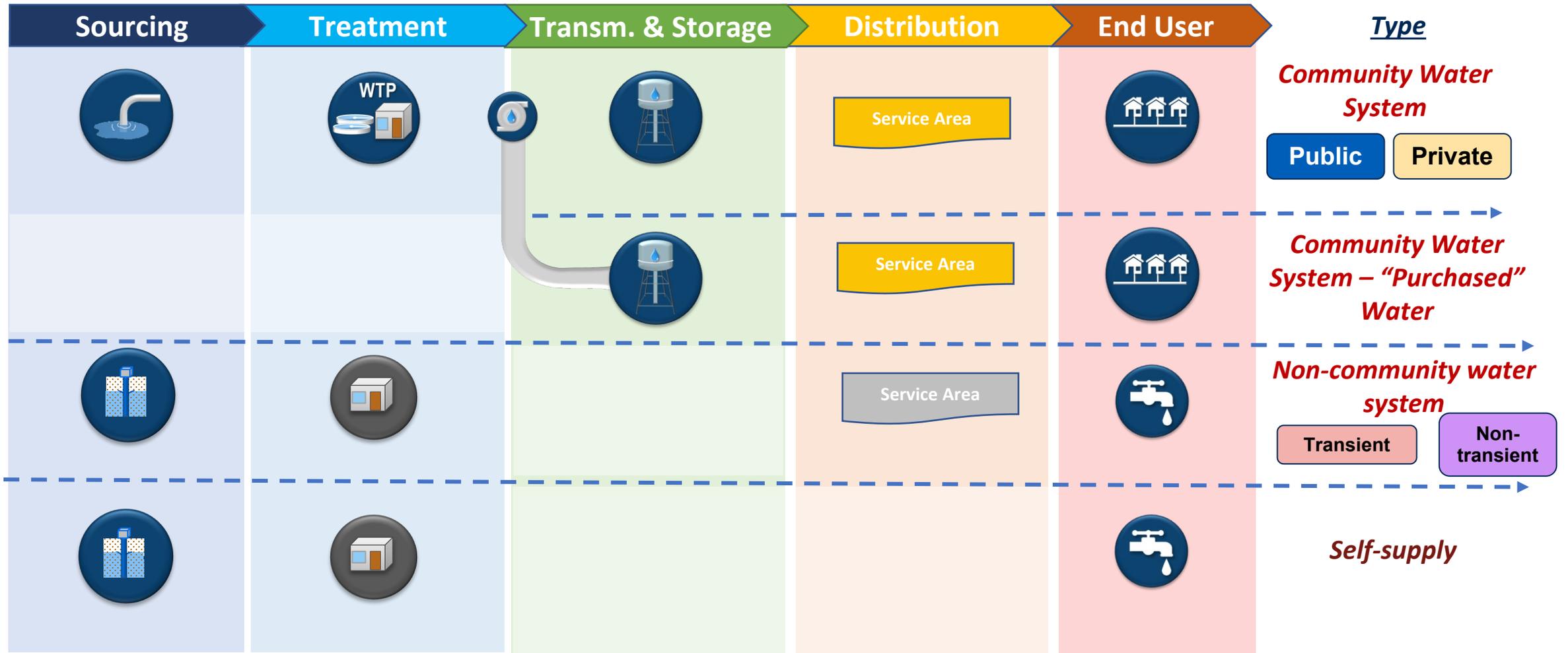
Junction Facility with defined location, capable of moving water, and **no** storage capacity, e.g., valves, pumps, meters.

Wastewater System Conceptual Overview...

- System stages and associated feature types

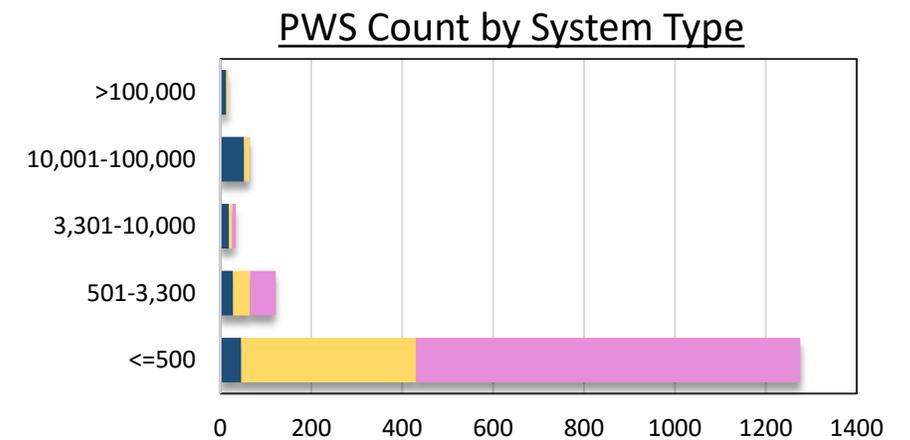
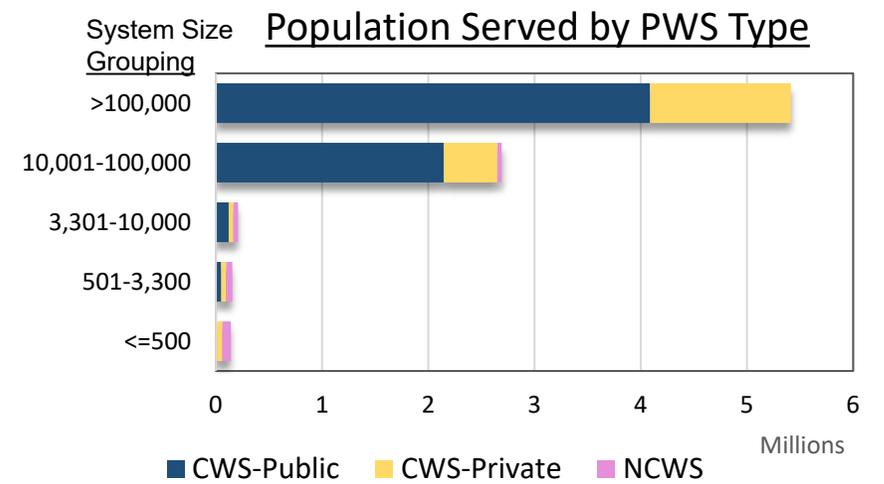
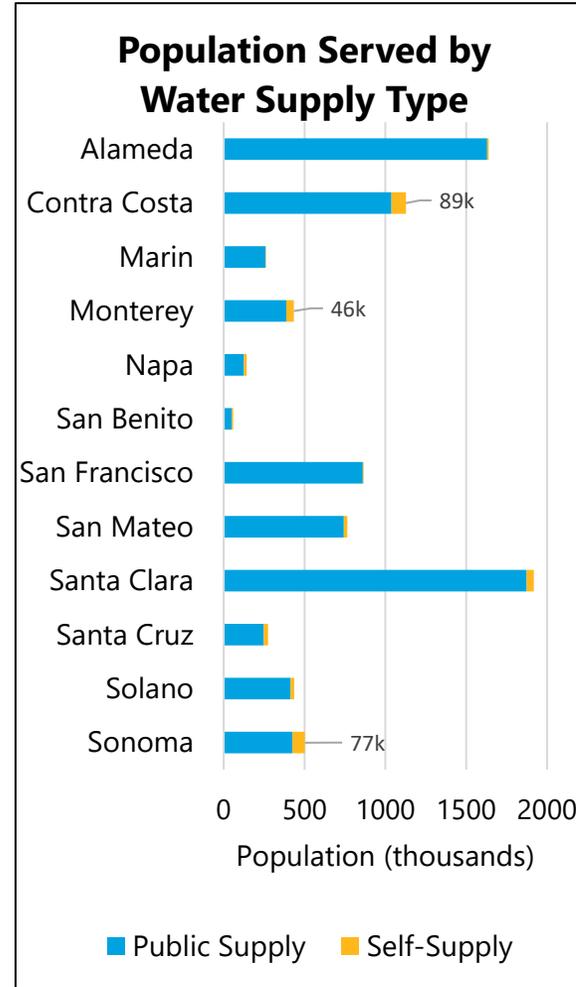
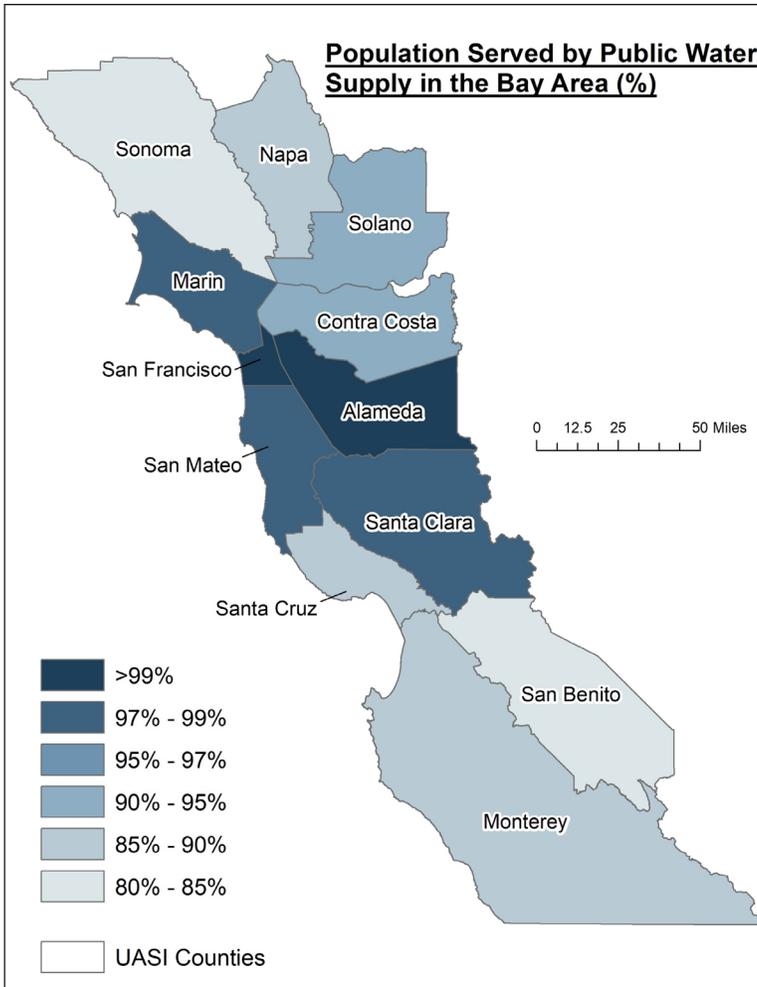


Water System Types



Water supply – Population Served by System Type

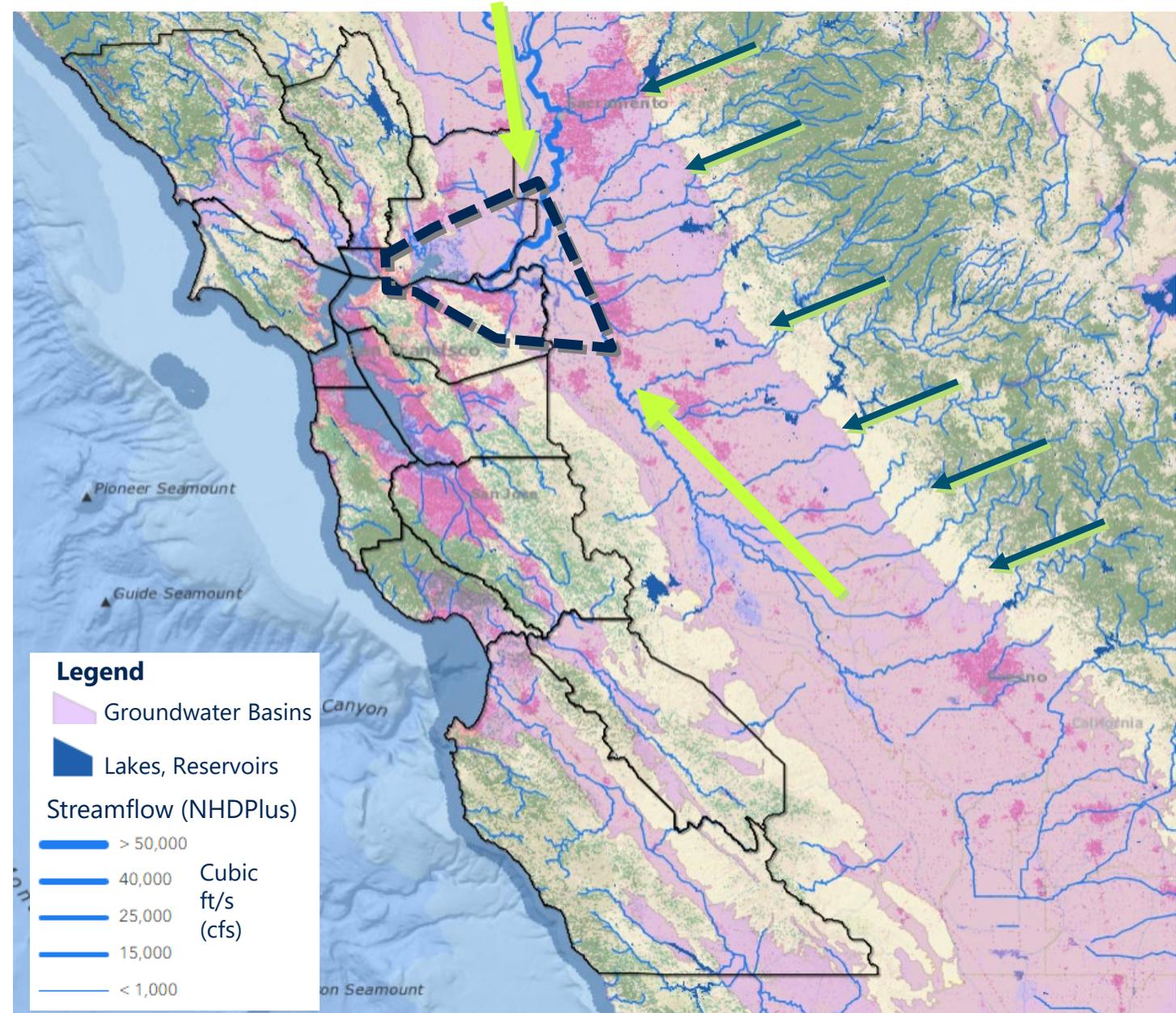
Key takeaways: >95% of the Bay Area’s population served by community water systems (CWS), with the remainder of the population (~500,000) served by small non-community water systems (NCWS) and self-supply (i.e., own wells).



Source: USGS, [Estimated Use of Water in the United States](#) (2015 conditions),); [EPA SDWIS](#) (2022);

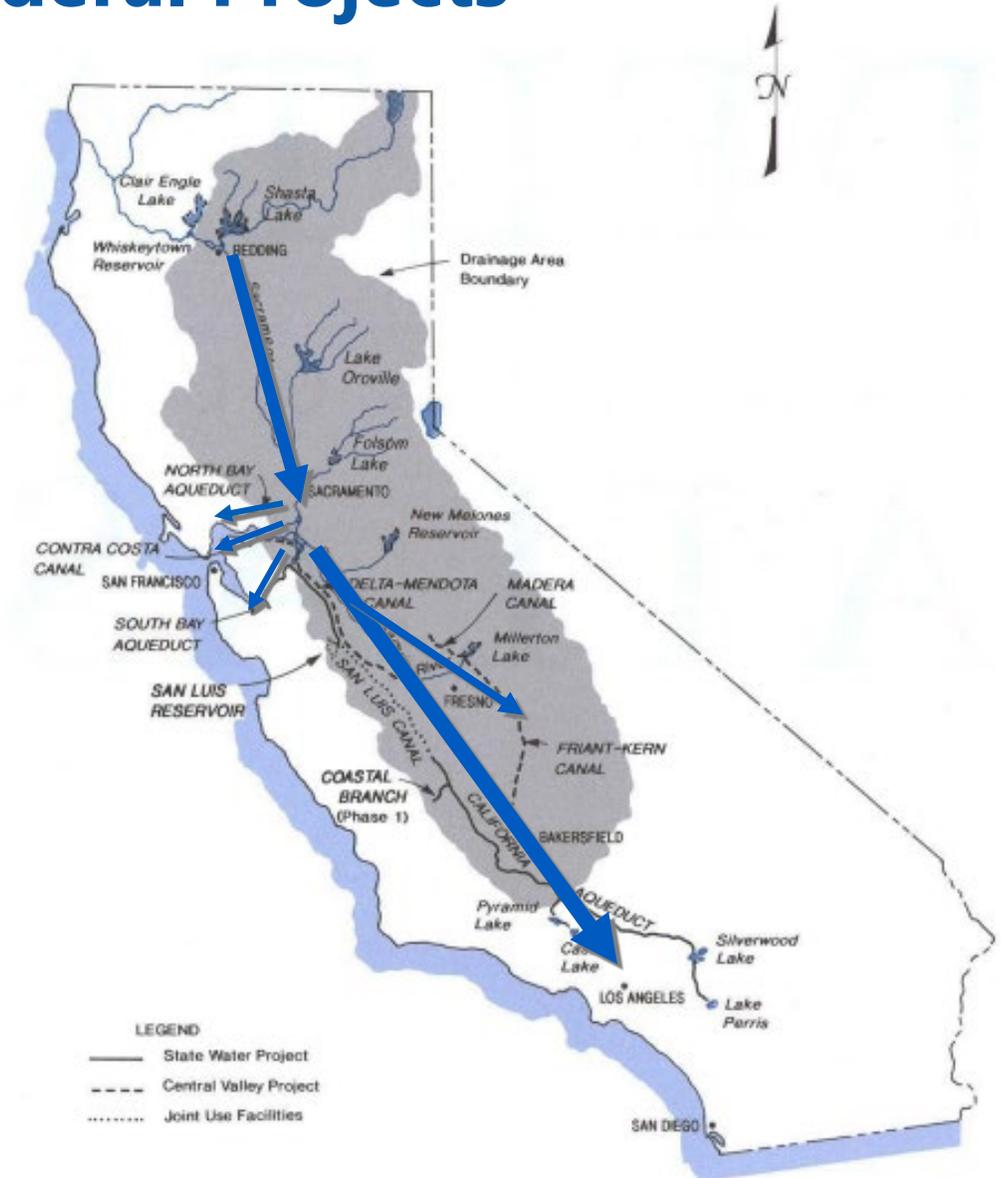
Sourcing- Hydrology Overview

- The Bay-Delta estuary is the hydrologic “hub” of California **surface water**, bringing together flows from North and South in the Central Valley.
- Majority of the river flow from runoff and snowmelt in the watersheds in the Sierra Nevada mountains.
- Major **groundwater** aquifers are found throughout the Central Valley, but also in areas around the Bay, and in river valleys (e.g., Sonoma, Monterey counties).

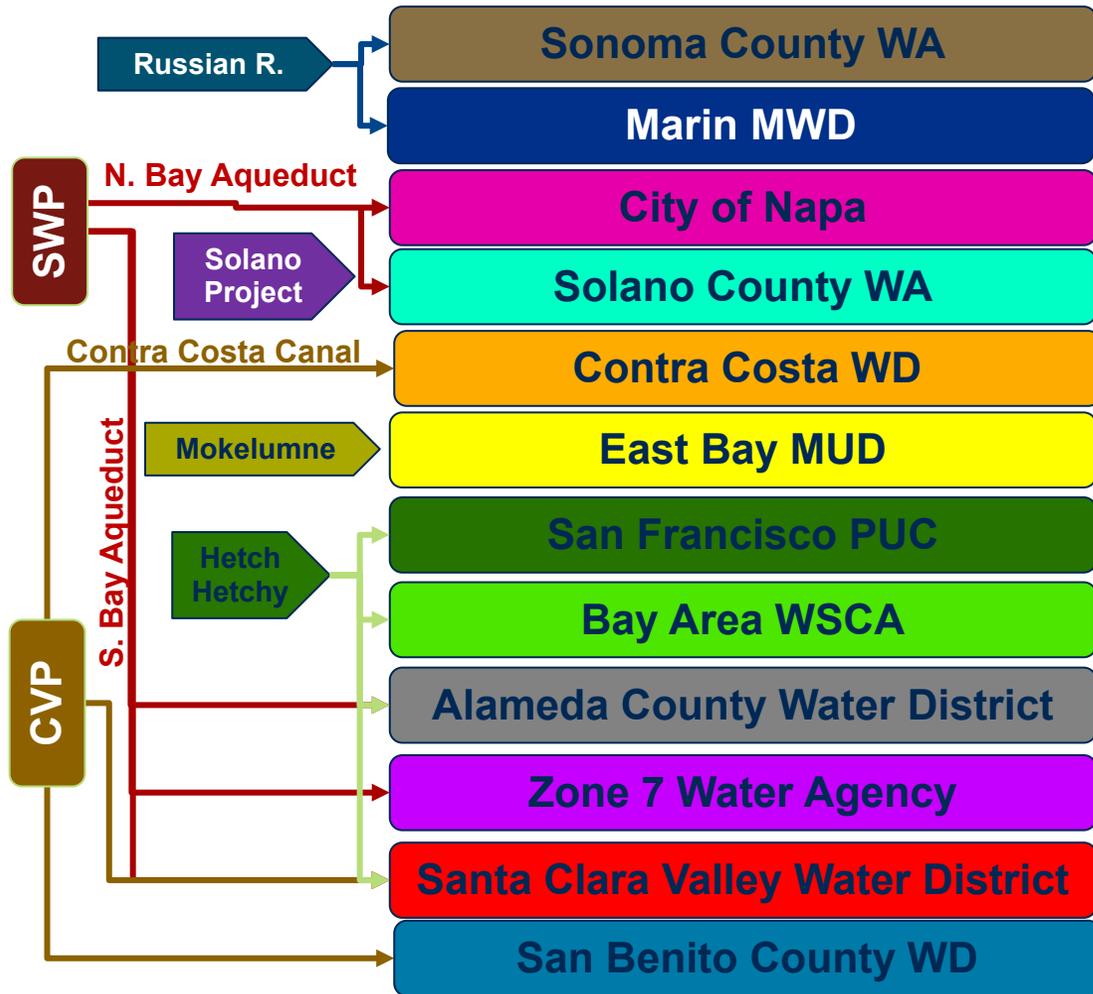


Water Transmission – State and Federal Projects

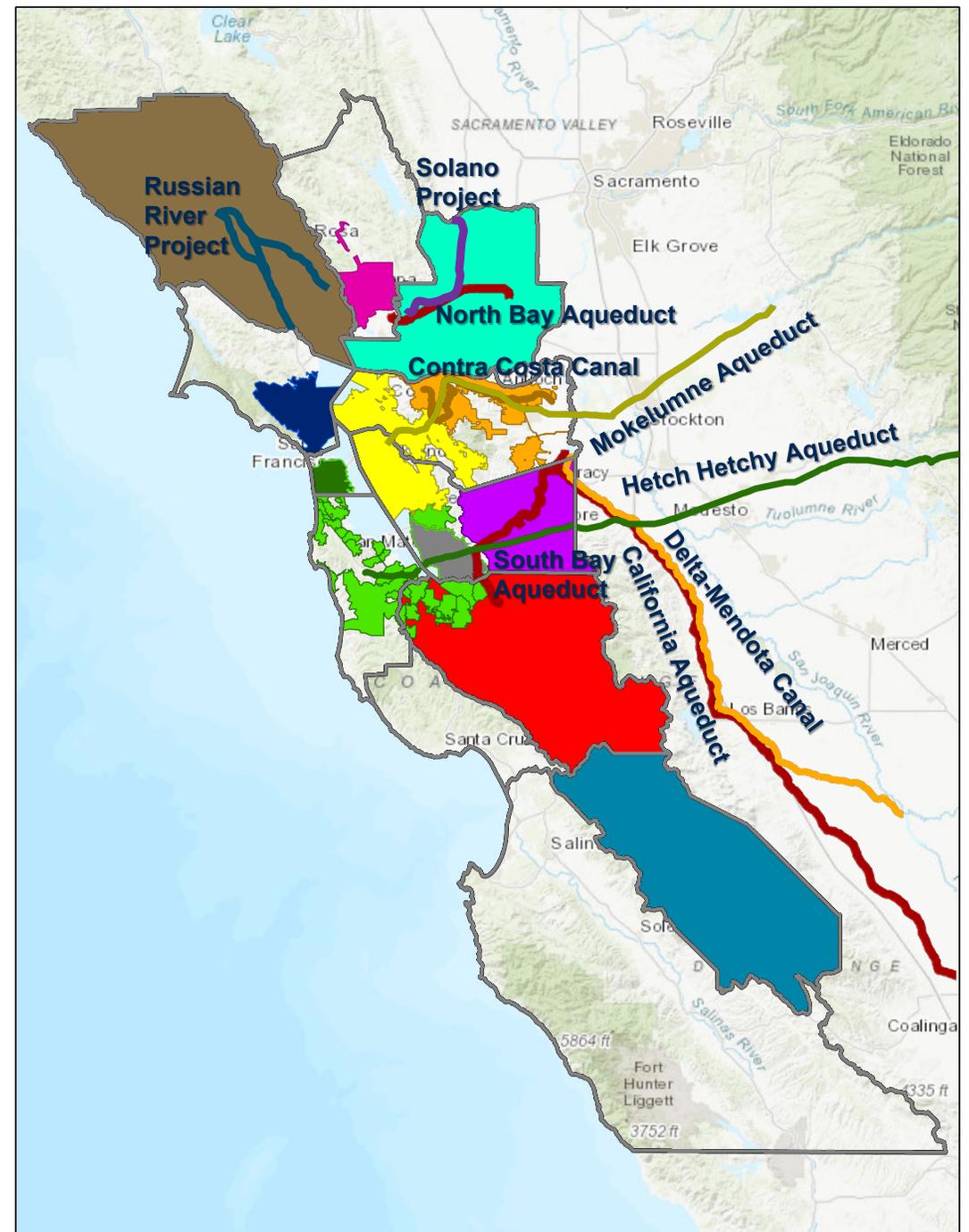
- California's Central Valley Project (CVP) and State Water Project (SWP) supplies water to millions of people throughout California.
 - The CVP is a "multi-purpose network of dams, reservoirs, canals, hydroelectric powerplants and other facilities," primarily supplying water to the Greater Sacramento and San Francisco Bay areas.
 - The SWP "is a multi-purpose water storage and delivery system that extends more than 705 miles" and consists of a "collection of canals, pipelines, reservoirs, and hydroelectric power facilities."
 - Supplies 27 million Californians with water, including notably, the Los Angeles area.
 - The California Aqueduct (SWP) and Delta Mendota Canal (CVP) are the major flow paths for water moving from the Bay-Delta to water users in the Southern portion of the Central Valley and Southern California.



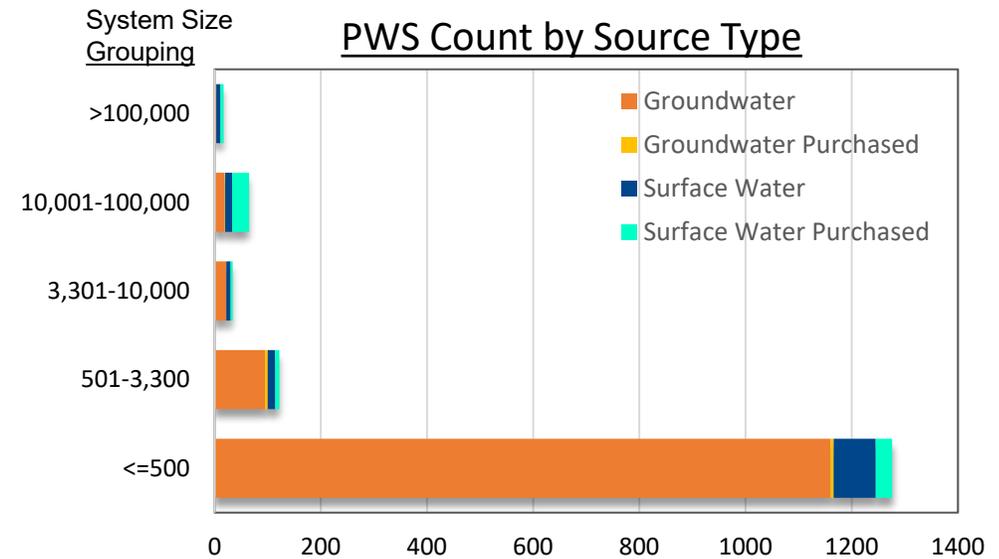
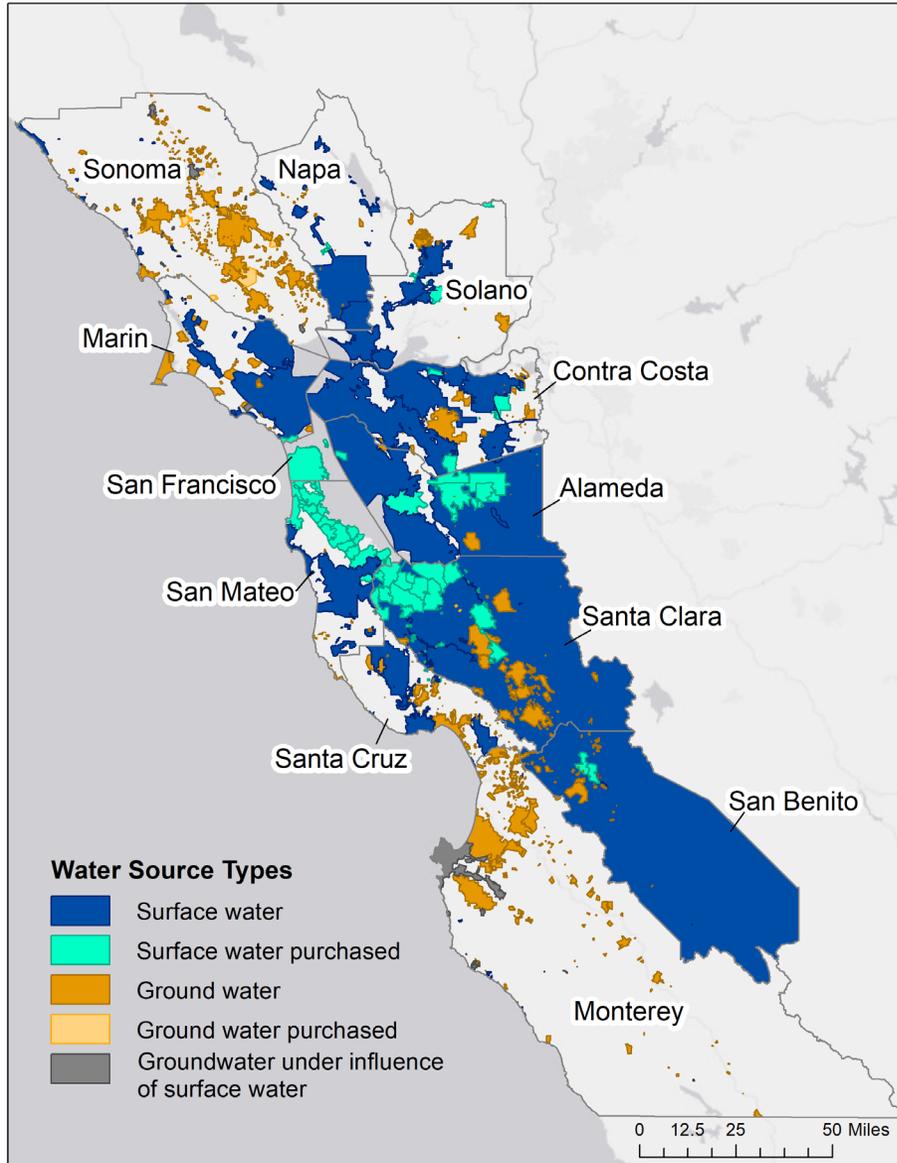
Sourcing → Transmission in the Bay Area



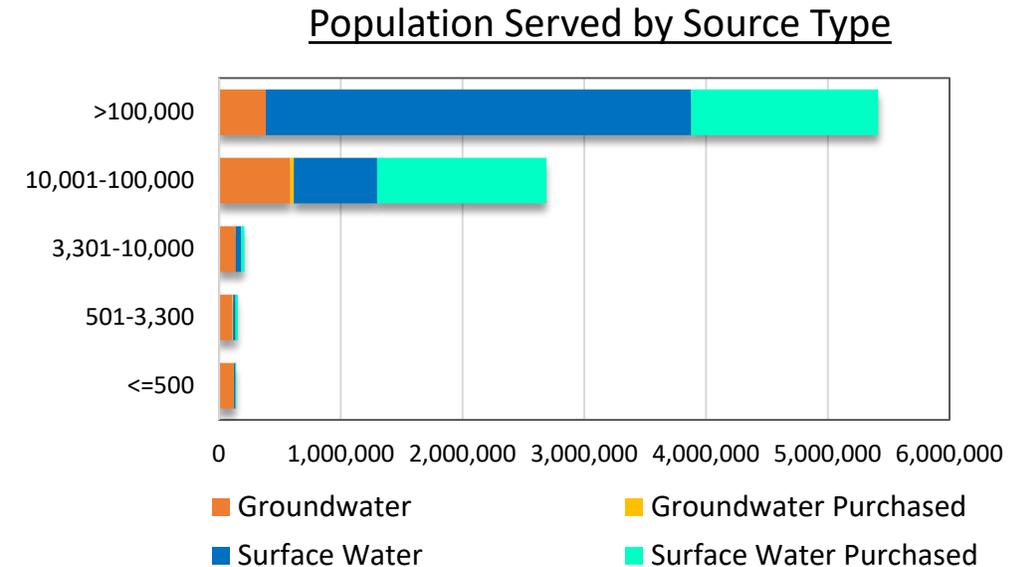
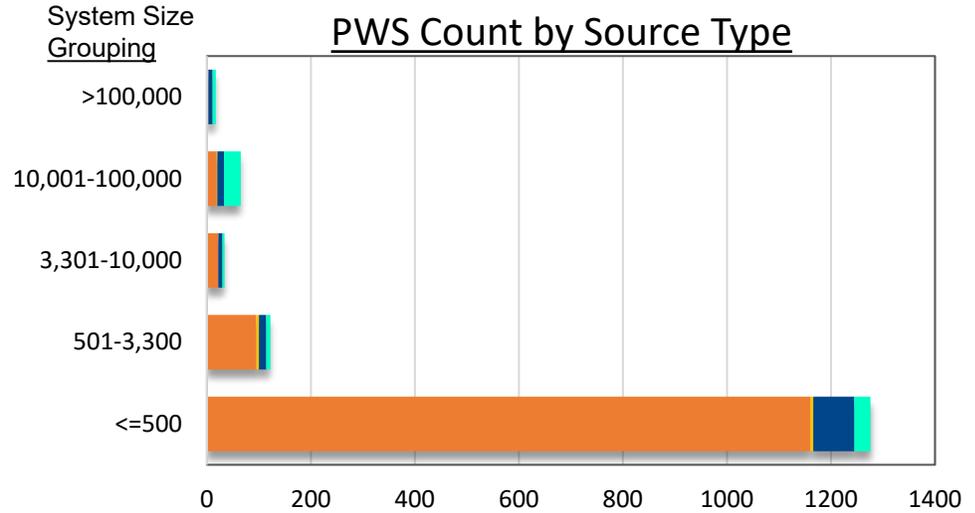
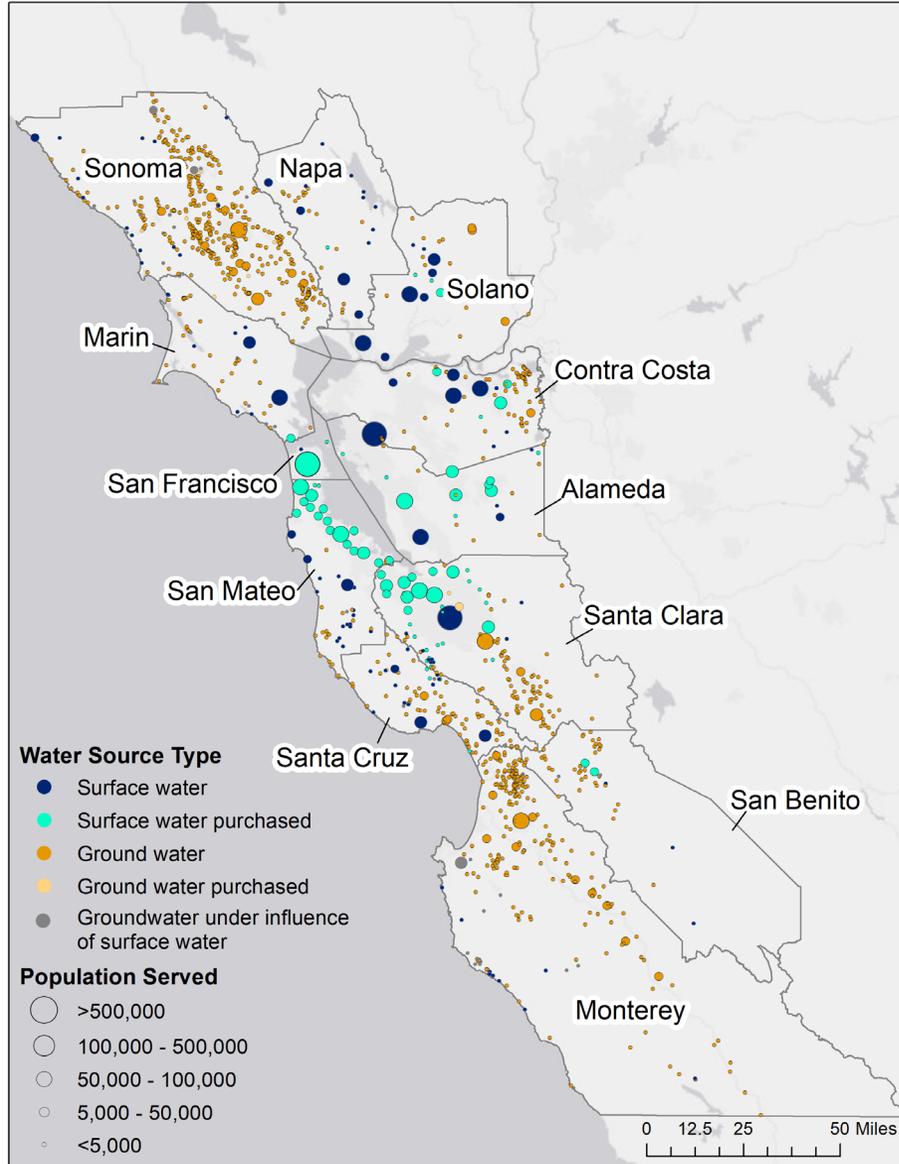
Source: [CVP](#), [Contra Costa Canal](#)



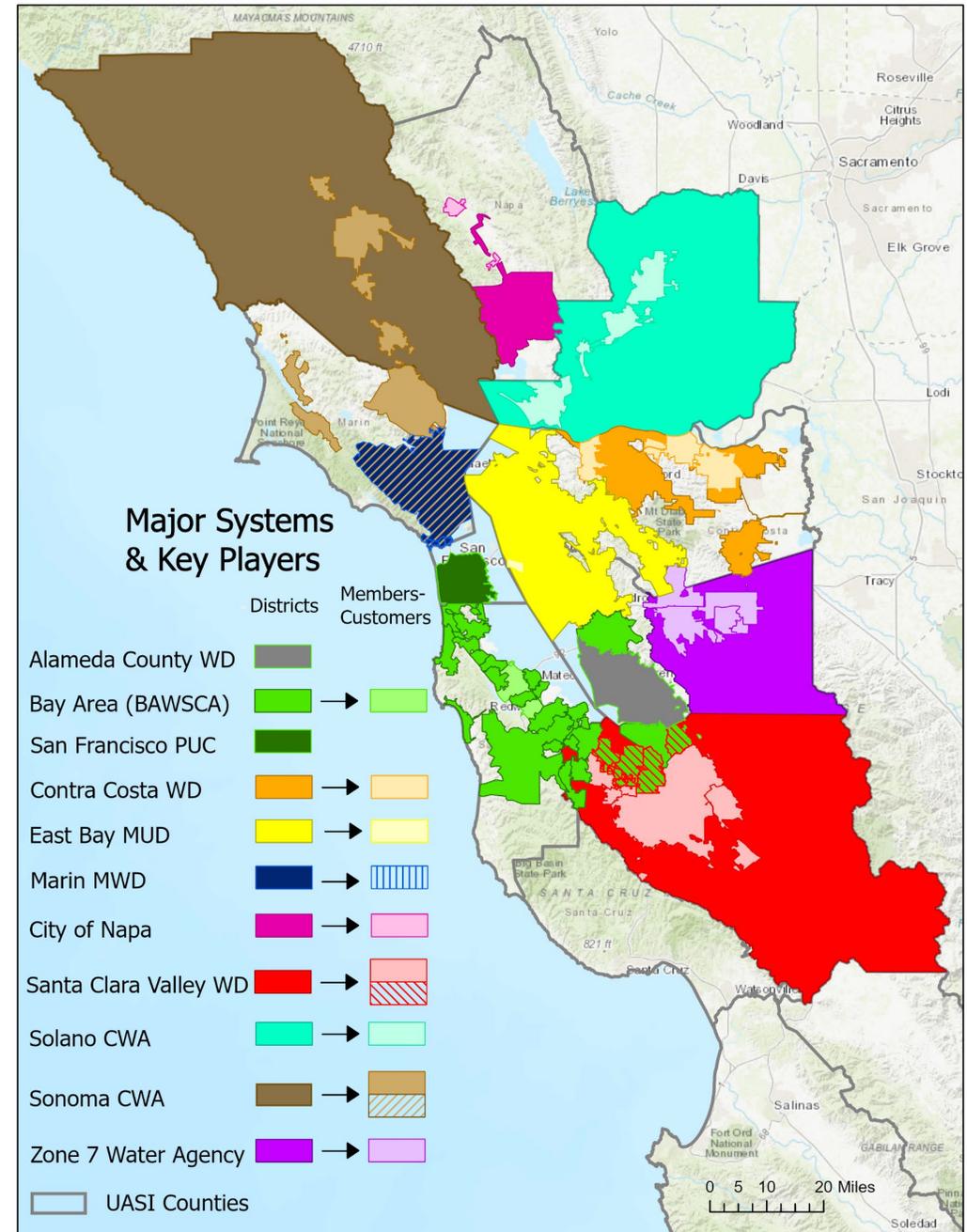
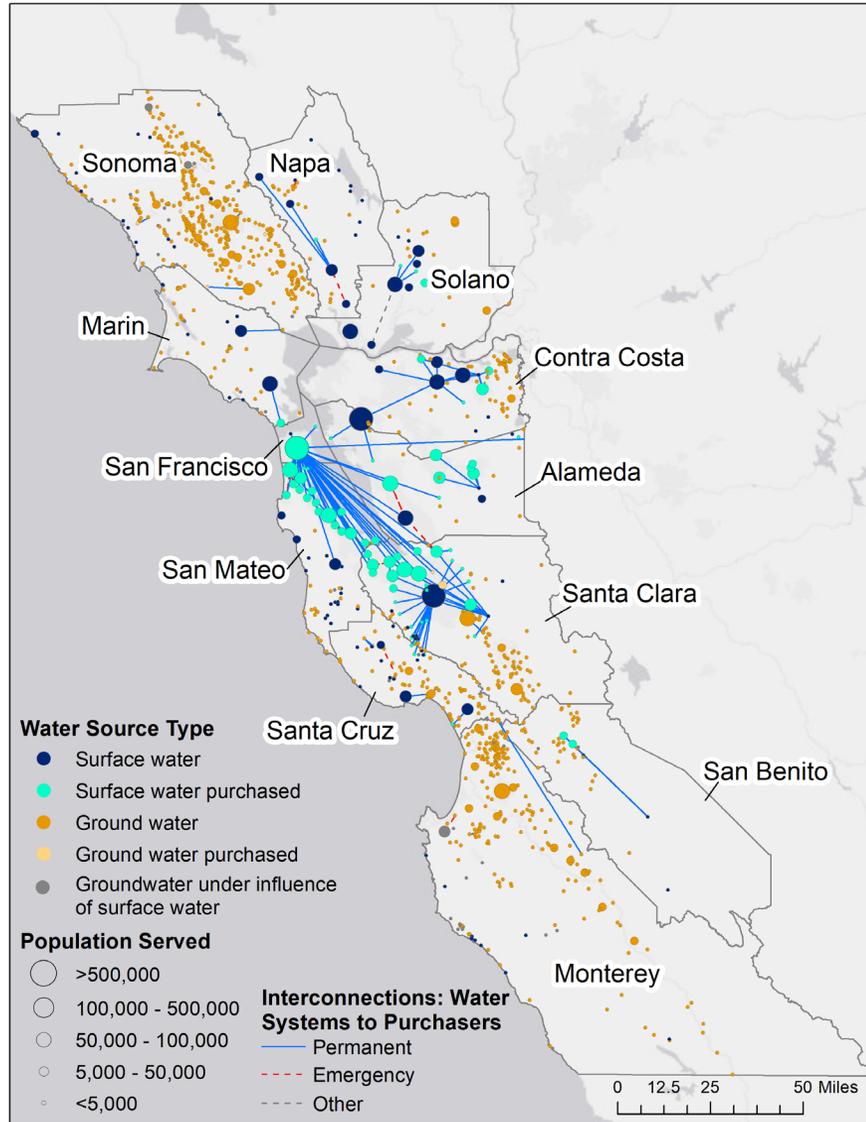
Water Systems by Primary Source Type and Size



Water Systems by Primary Source Type and Size



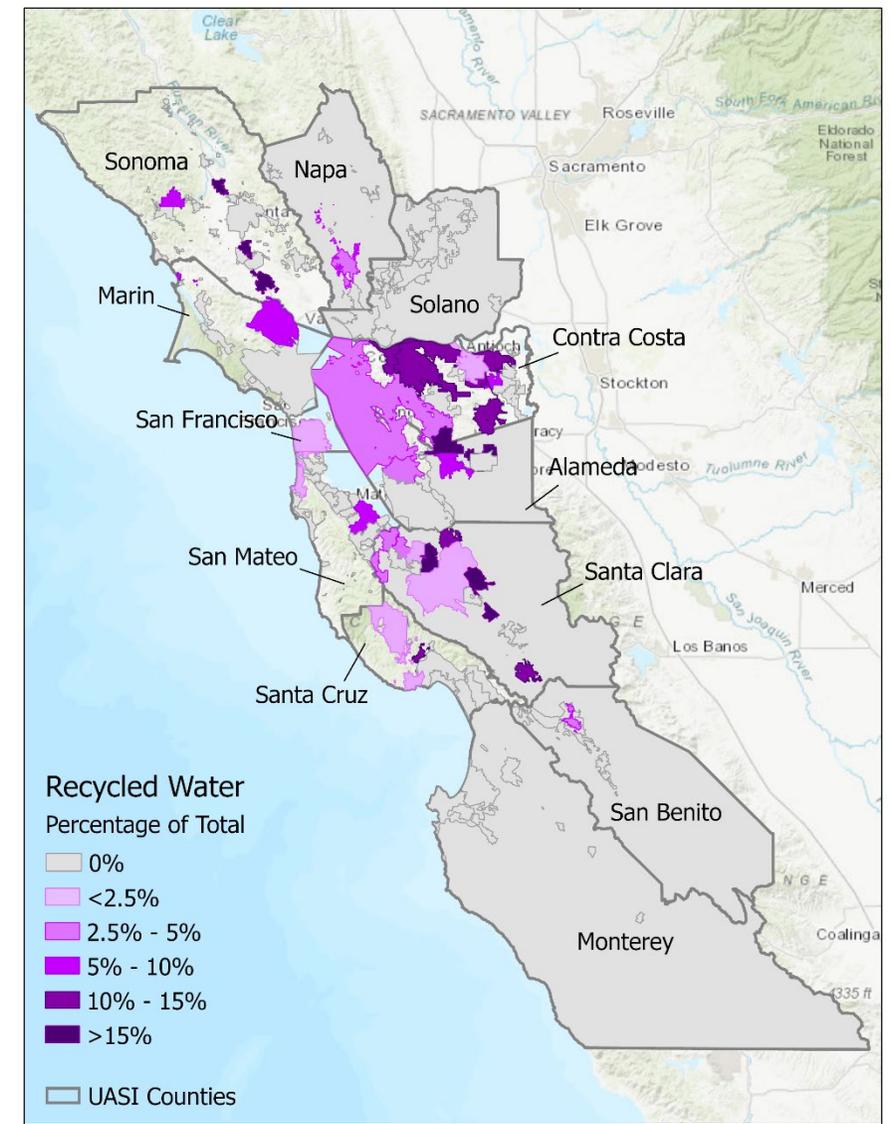
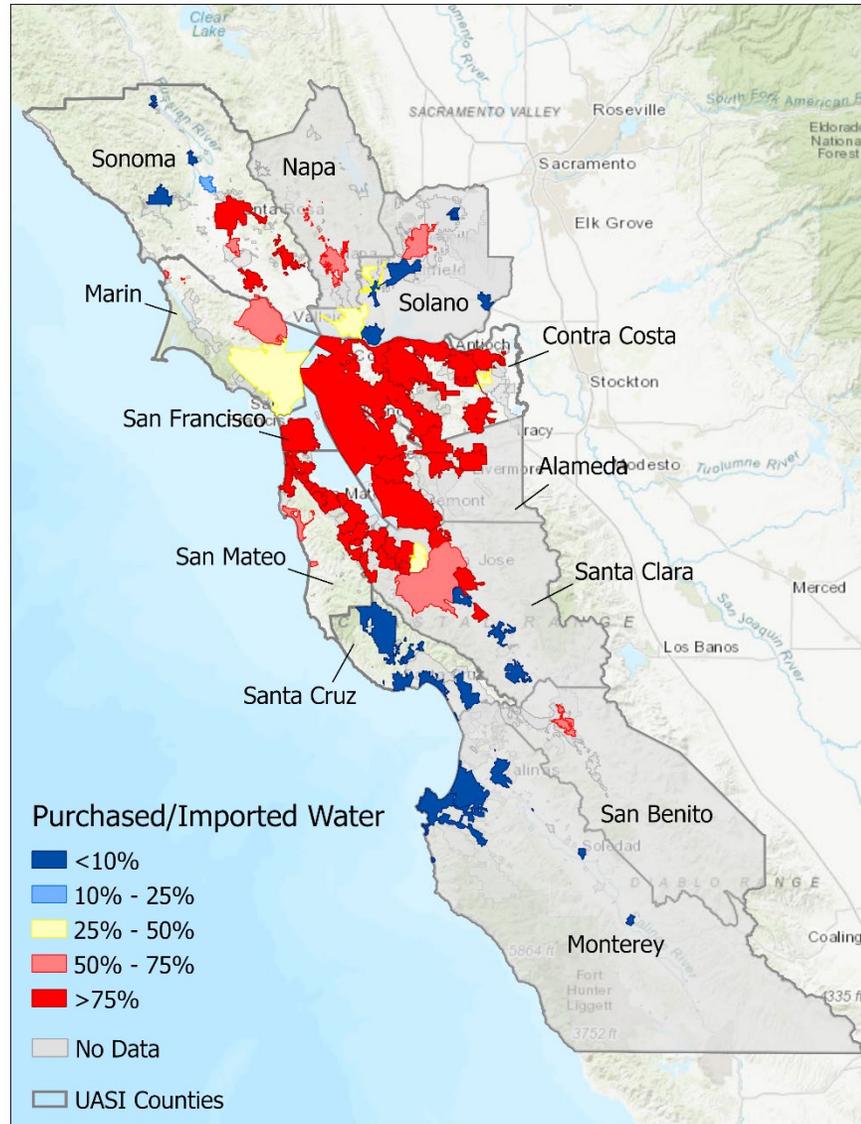
Interconnections largely follow regional networks



Source: [SWRCB – Water Service Areas](#) (2021); [EPA SDWIS](#) (2022);

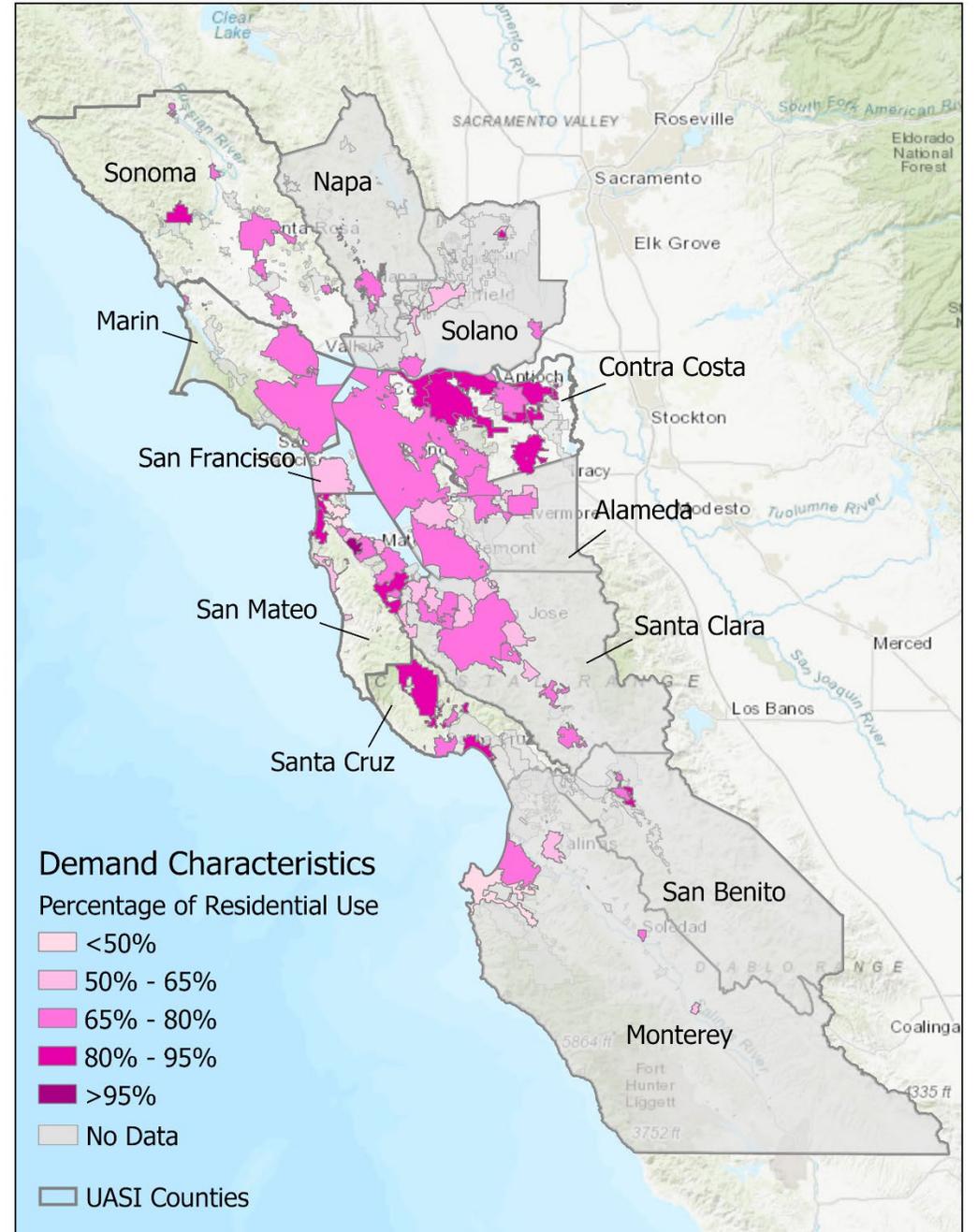
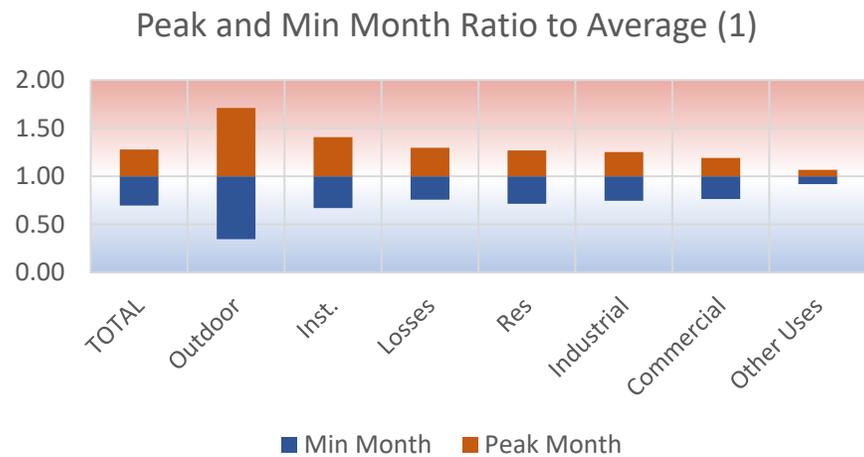
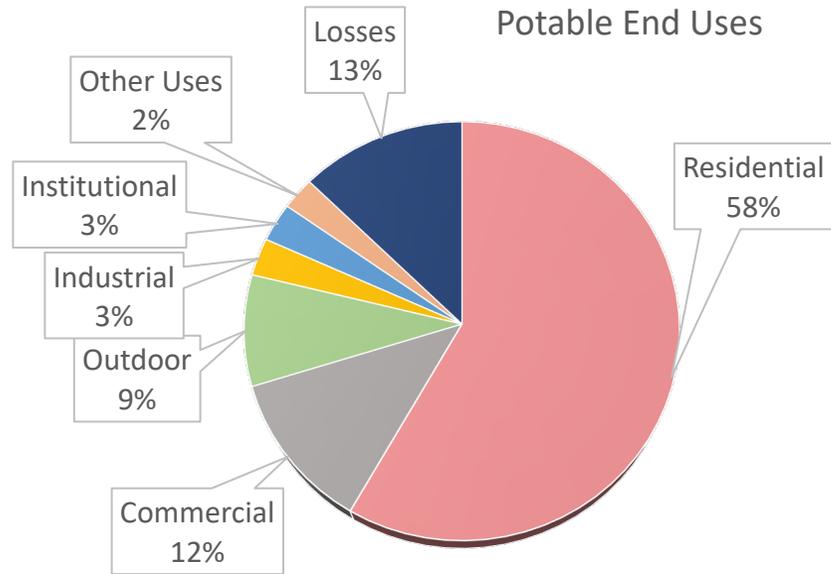
Local sourcing percentage – Retail water service areas

The major water systems in the core of the region rely more heavily on imported sources, but may have more source diversity and interconnections. Water systems in the Northern, Southern parts of the region have more local sourcing, but fewer options for emergency or alternative sourcing.



Source: Cal DWR – [2020 Urban Water Management Plans](#), SWRCB (water service areas)

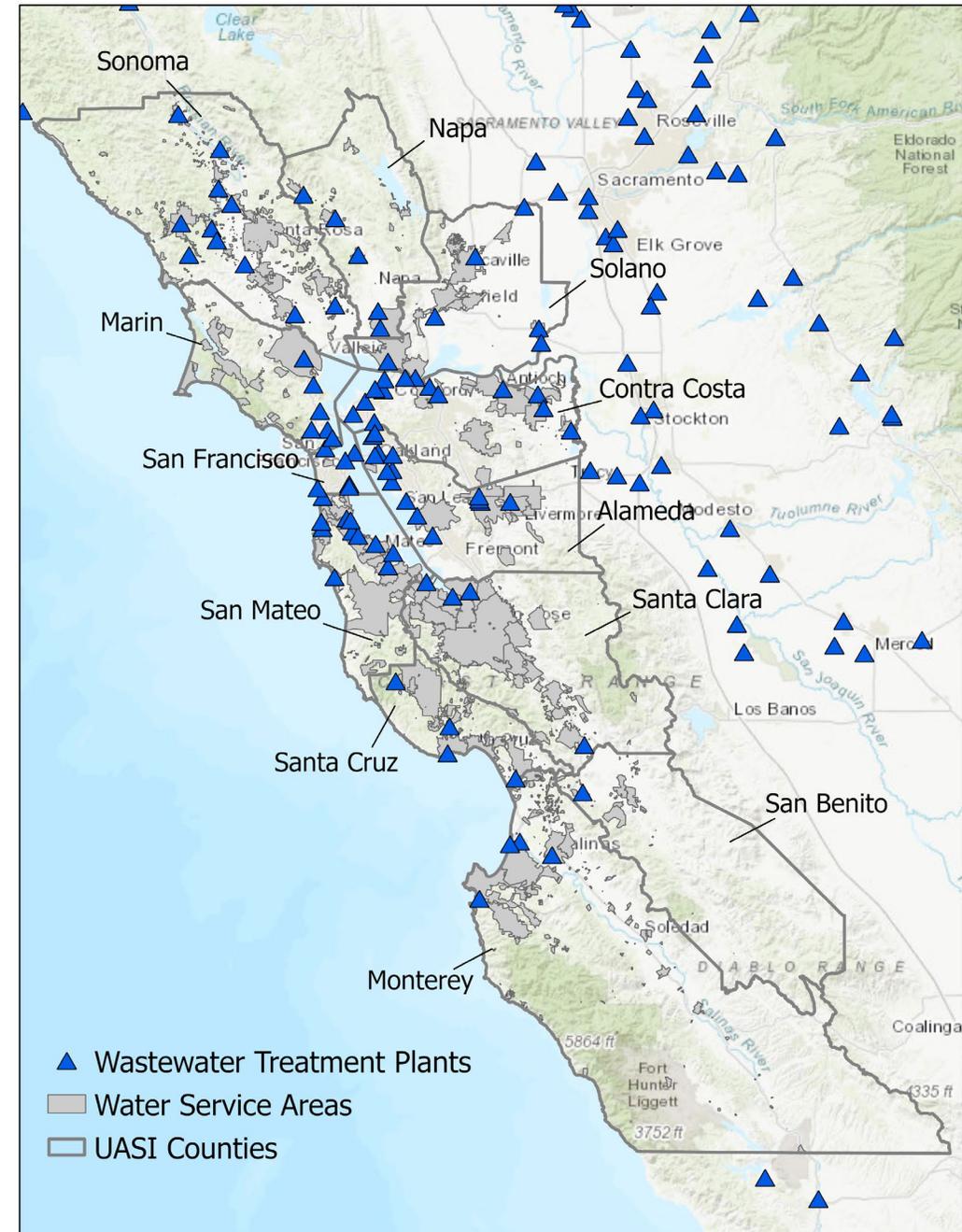
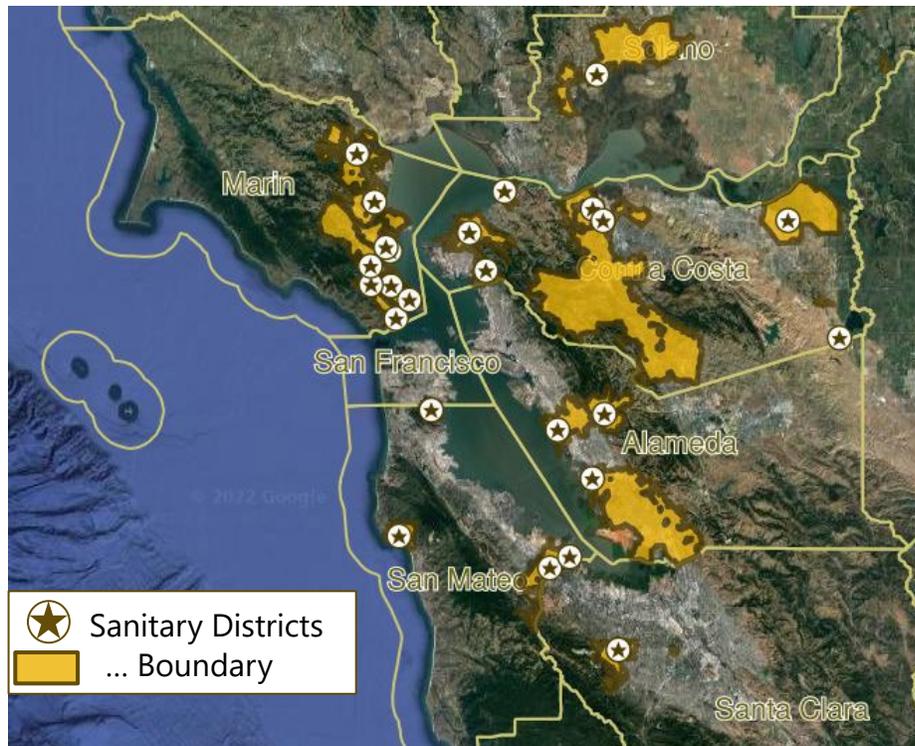
End Uses by Sector (Potable)



Source: Cal DWR – [2020 Urban Water Management Plans](#), SWRCB (water service areas)

Wastewater Systems

- In general, most water service providers also provide wastewater service.
- Treatment plants tend to be near rivers or the Bay. Several connected to water reuse.
- Some sanitary districts provide independent wastewater service:



Water system - Dependencies overview



Stage:	Source	Treatment	Storage	Distribution	Usage	Wastewater
Infrastructure	Wells, pipelines	Treatment plants	Tanks, towers	Pumps, pipes	Meters, Fixtures	Sewers, treatment plants, pumps/lift
Key Inputs						
Other needs	Water rights, Planning	Permits, WQ testing		WQ testing, flushing	Planning, billing	Permits, DMRs

Legend: source water; electricity/fuel; computer systems/internet; chemicals; certified personnel; equipment/crews;

Water Systems during Disasters – Consequence Types

Disruption Type	Description	What can be done
Water outage 	Water does not make it to a given end point in the system	Repair broken component; Restore power; Activate alt. supply; Fire watch; Alt. fire fighting water; Limited Evacuation; Potable tankers; Bottled water;
Water shortage 	Water at source or in storage is limited and may continue declining.	Conservation (voluntary, mandatory); Activate alt. supply; Alt. sourcing for some end uses;
Boil water advisory/notice 	Quality can not be guaranteed for end users with potential for biological contaminants (that can be killed via boiling)	Restore system to normal function; Flush lines; Public messaging; Temporary closure of facilities; Potable tankers; Bottled water distribution;
Do not drink  	Possible chemical or other contamination that can't be addressed by boiling.	Restore system to normal function; Flush lines; Switch to alternate source/treatment; Public messaging; Facility closures; Limited evacuation; Water tankers; Bottled water distribution;
Do not use  	Hazardous chemical in water with potential for health and safety impacts by any usage.	Restore system to normal function; Flush lines; Switch to alternate source/treatment; Public messaging; Facility closures; Limited evacuation; Fire watch; Alternative firefighting;

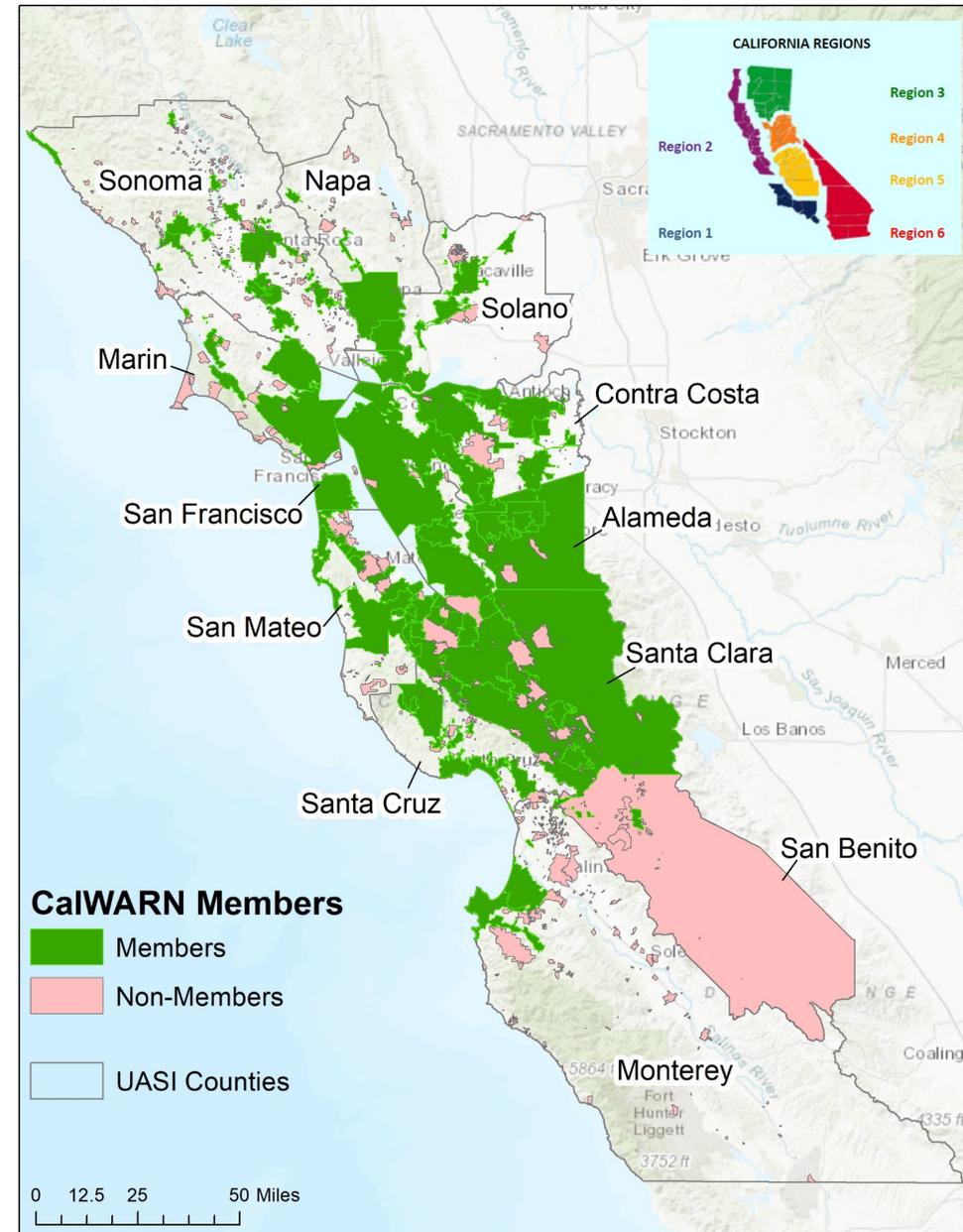
Water Impacts during Disasters – Possible Causes by Stage

Impact	Source	Treatment	Trans./ Storage	Distribution	End Users
Water Outage 	Complete source failure	Damage, Shutdown	Damage, Pump failure	Line break; Shut off for repair;	Service line break
Water Shortage 	Drought, source failure	Demand >> capacity	Pump or storage failure	Severe leaks (uncontrolled)	High usage vs source cap.
Boil water advisory/ notice 	Severe or novel biological contaminant	SCADA Outage, Contaminant detected (post-treatment)	Pump failure, line break, water tower failure	Pressure drop, line break(s), contaminant detection	Flooding with contaminant detected
Do not drink  	“Difficult” contaminant detected	Contaminant detected		Pressure drop and possible contamination	
Do not use  	Contaminant in source (not treatable)	Contaminant detected		Pressure drop and possible contamination	

CaIWARN



- California's Water/Wastewater Agency Response Network (CaIWARN) is a voluntary coordinating body organized by the American Waterworks Association (AWWA), whose mission is *"to support and promote statewide emergency preparedness, disaster response, and mutual assistance processes for public and private water and wastewater utilities."*
- CaIWARN is organized into regions. All BA-UASI counties are in the Coastal Region (2).
- CaIWARN coordinates with CalOES, as well as State DWR, Dept. of Public Health, California Utilities Emergency Association, Cal. Rural Water Association, and Cal. Sanitation Risk Management Agency.
- Agencies must be signatories to access CaIWARN resources. *(Better to join before the disaster strikes.)*



Source: CNA. Data: CaIWARN, 2022. (<https://www.calwarn.org/>)

MODULE 3

Synthesis, Dependencies, and Emergency Management Roles and Expectations

Towards a broader understanding, next steps

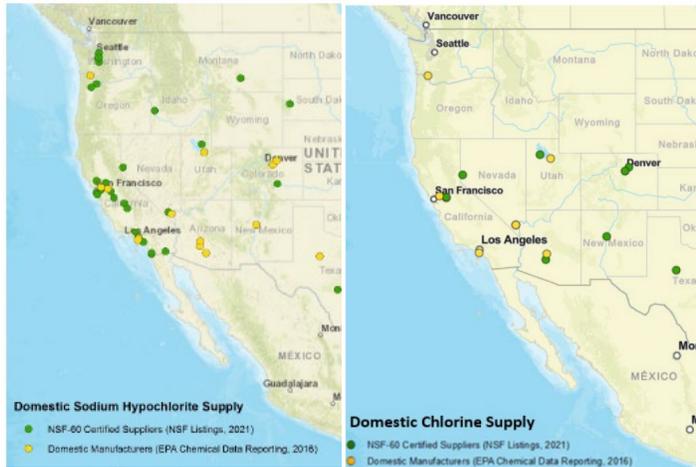
- Dependencies and Critical Enablers
 - Refined Petroleum Fuels
- Remember Critical End Users that must provide food and/or water
- Emergency Management Roles in Supply Chain Resilience
 - Water Sector Resilience
 - Food Sector Resilience
- “Confluence” of Top Flows

- Review and next steps

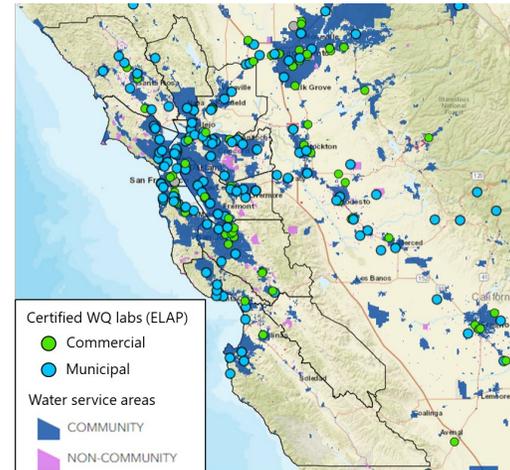
Remember dependencies and critical enablers

- All supply chains depend on utility services, resource inputs, and other critical enablers (e.g., truck drivers)

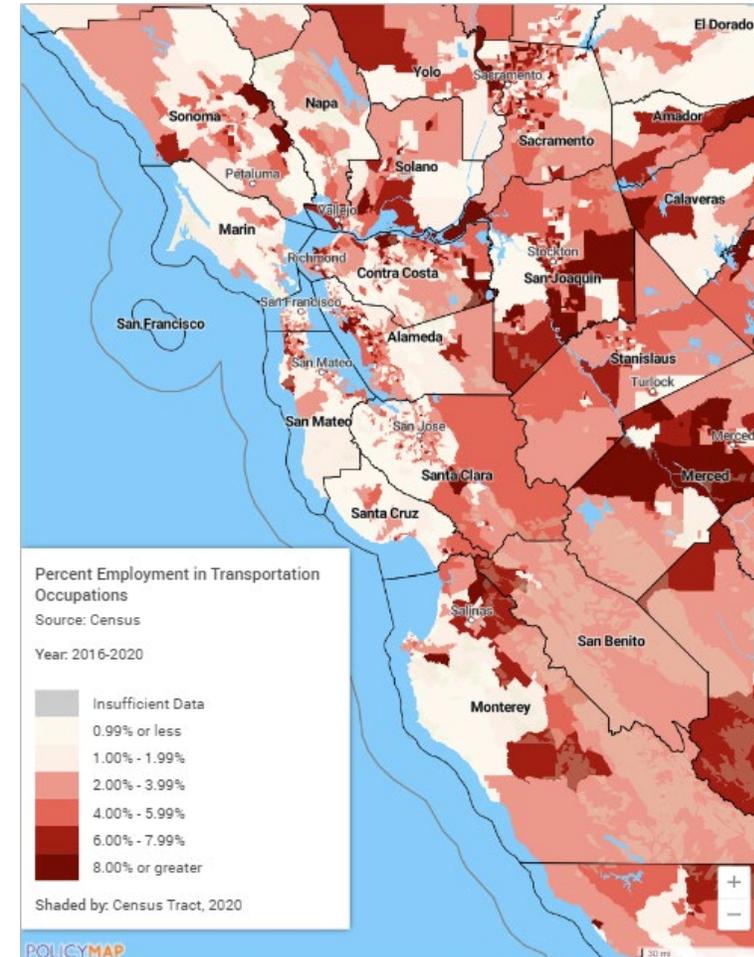
Water Treatment Chemicals



Certified WQ Labs



Trucking Workforce



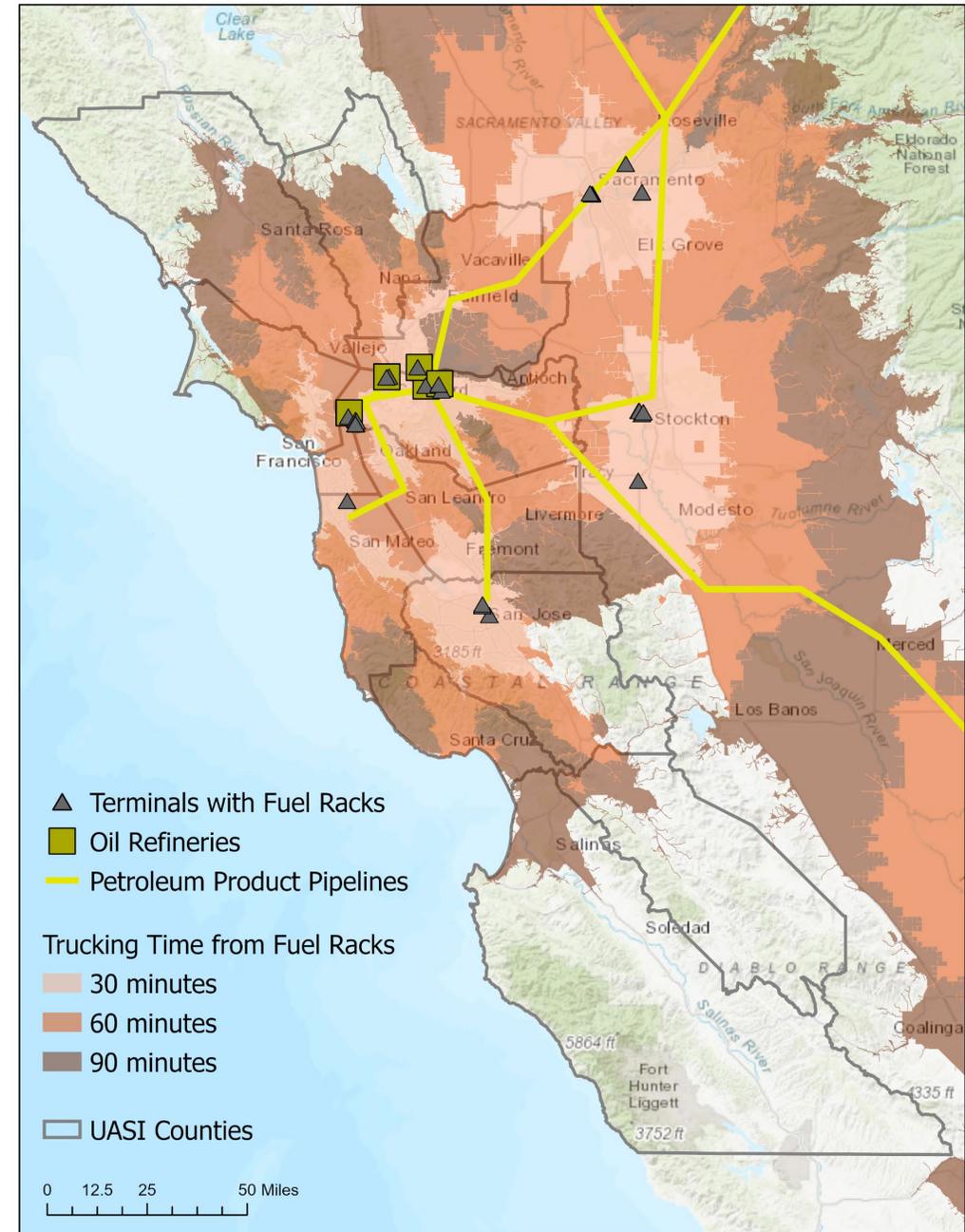
Sources: EPA via [CISA](#) (2021), SWRCB (2022), Census (2020) via PolicyMap

Critical Dependency - Fuel

- Distribution by truck depends on fuel.
- If power goes out, generators need fuel to power:
 - Water, wastewater treatment and pumping
 - Refrigeration in vehicles, warehouses



Source: CNA. Data source: EIA



Critical End Users (map)

Health

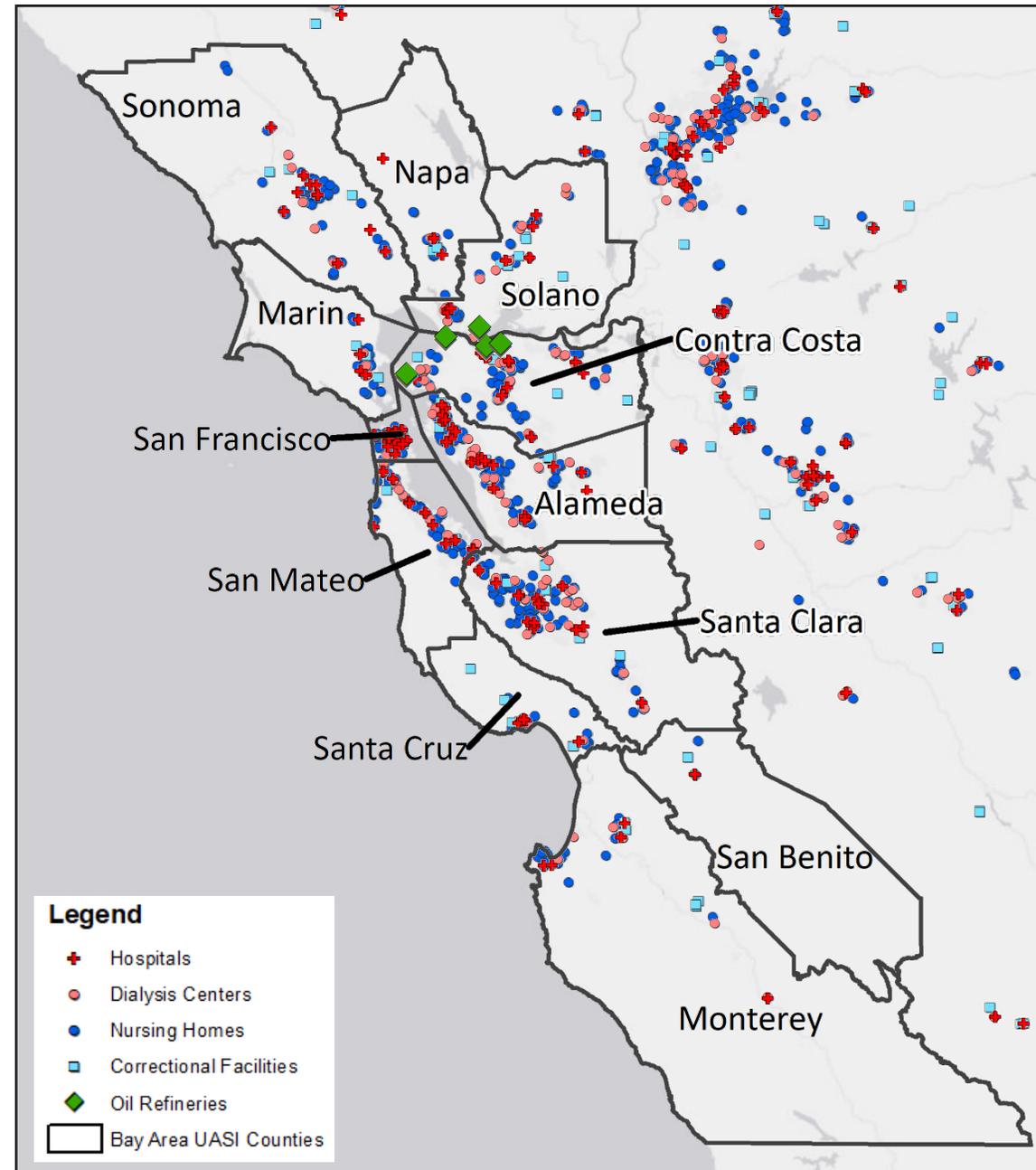
- **Hospitals**
- **Dialysis Centers**
- Outpatient centers
- Health Centers/Clinics

Group Quarters

- **Nursing homes, LTCFs, ICFs, hospice**
- **Correctional**
- Dormitories
- Shelters

Industrial, Other CI

- **Refineries, terminals**
- Generating units
- Data centers
- Transportation hubs Others



Emergency Management roles in supply chain resilience

Pinch-Hitter

Replace flows
MREs
Bottled Water
Feeding Centers
CPODs
Cross-docks
Trucking

Sometimes competes with existing flow

Informer

Roads Open
Grid Status
Telecom Status
Fuel Status
Demand Dynamics
Big Picture

Gap-Filler

Using supply chain informed targeting:

Supplement flows
MREs
Bottled Water
Feeding Centers
CPODs
Cross-docks
Trucking, Fuel

Facilitator

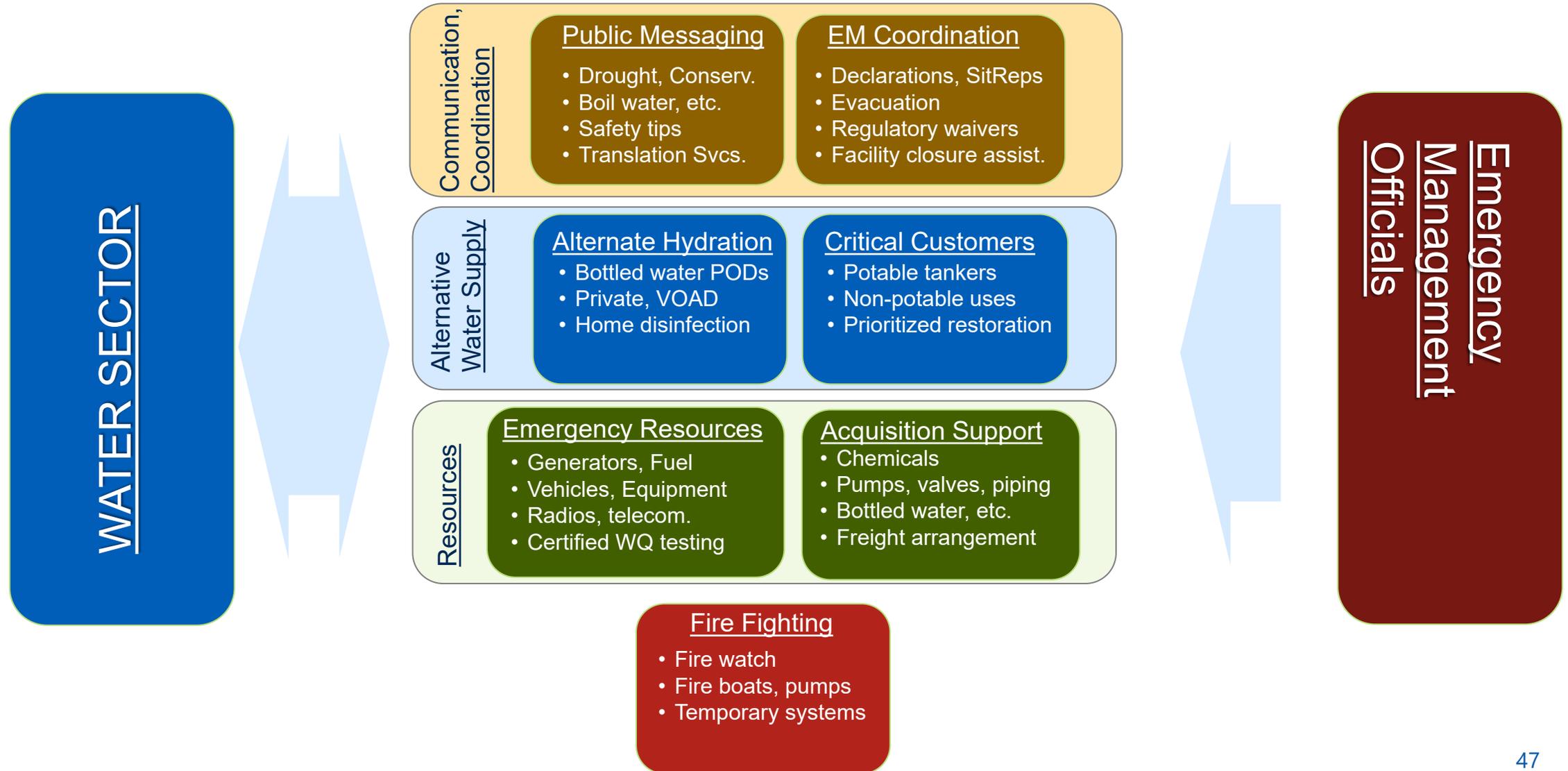
Prioritizing
Debris Removal
Grid Recovery
Fuel Access
More Time
More Weight
Staging/Drop-and-go spaces
Generators
Deconfliction
Demand Signals

Disruptor

Close Routes
Close Rest Areas
Delay
Neglect
Confuse
Mislead
Compete
Delay
Delay
Delay

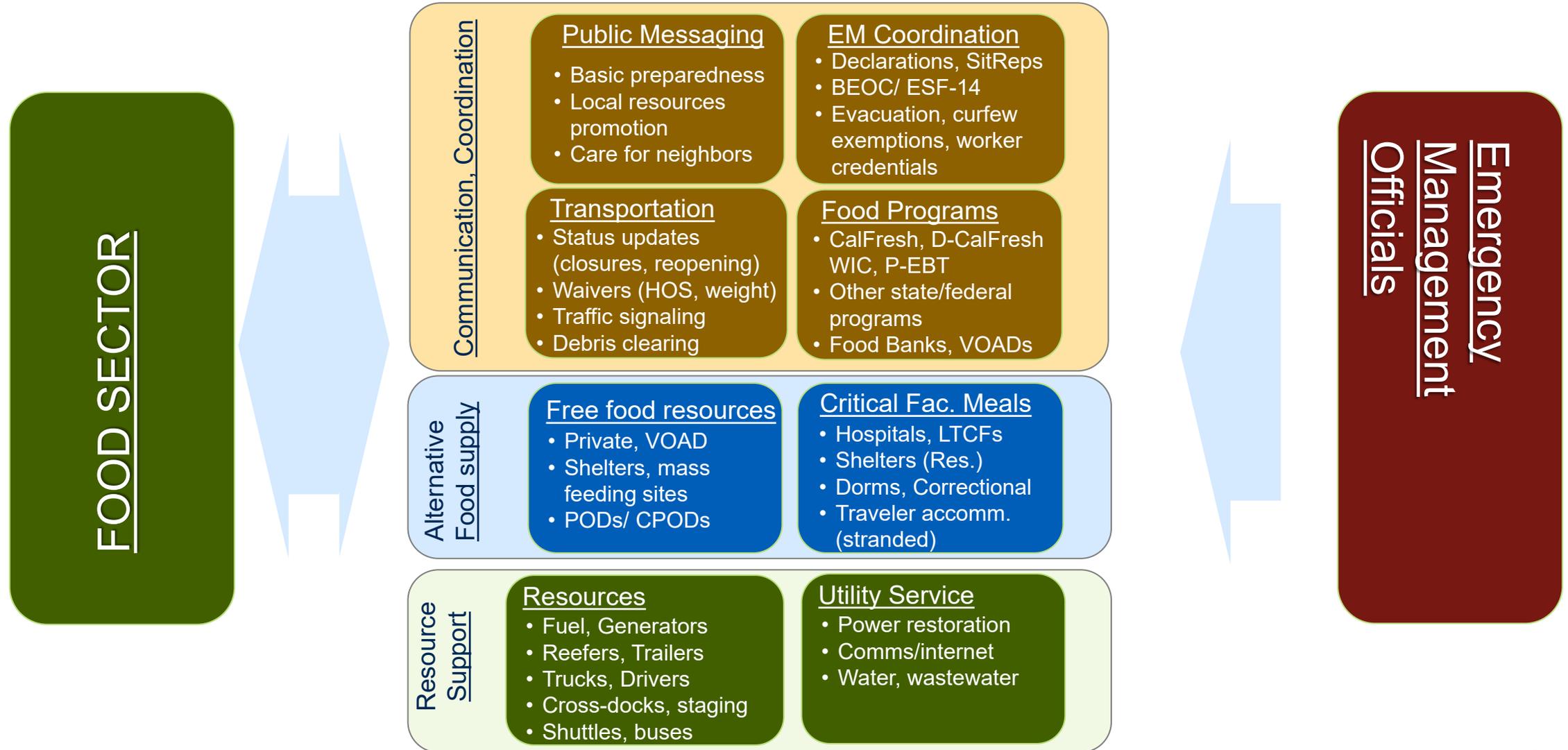
Water System and Emergency Management Coordination

What might the water/wastewater sector be looking for you to do/provide?



Food System and Emergency Management Coordination

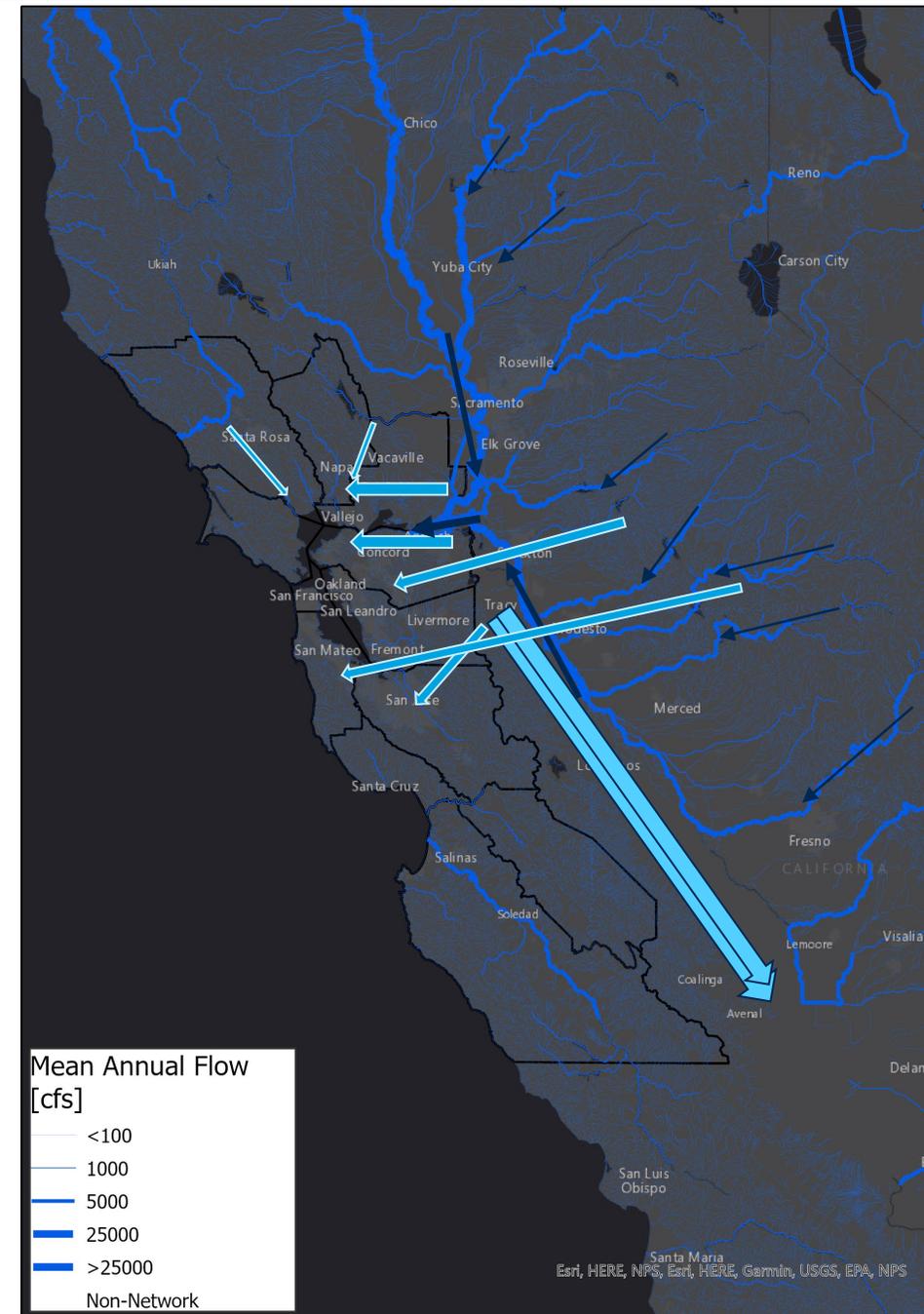
What might the food sector be expecting you to do/provide?



Confluence: Visualizing Flows Together - Water

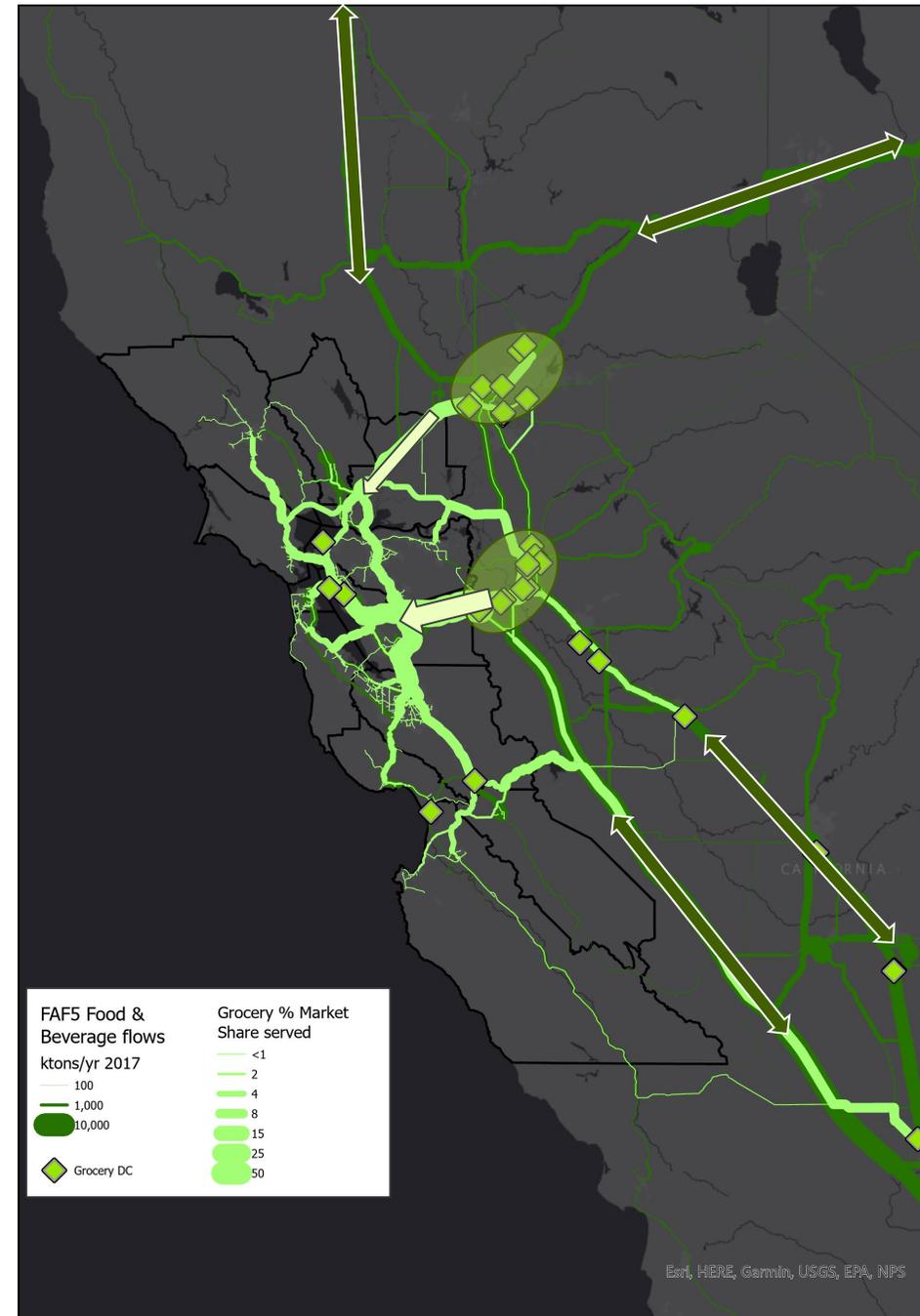
- Natural flows primarily from Sierra Nevada watersheds to the Central Valley to Bay-Delta estuary
- Major water projects (SWP, SVP) generally flow North to South, with smaller aqueducts delivering water to Bay Area from East to West.
- Local projects (Hetch-Hetchy, Mokelumne, Russian R.) generally move water toward more populated areas.

Source: CNA. Data sources: [USGS](#) NHDPlus v 2.1



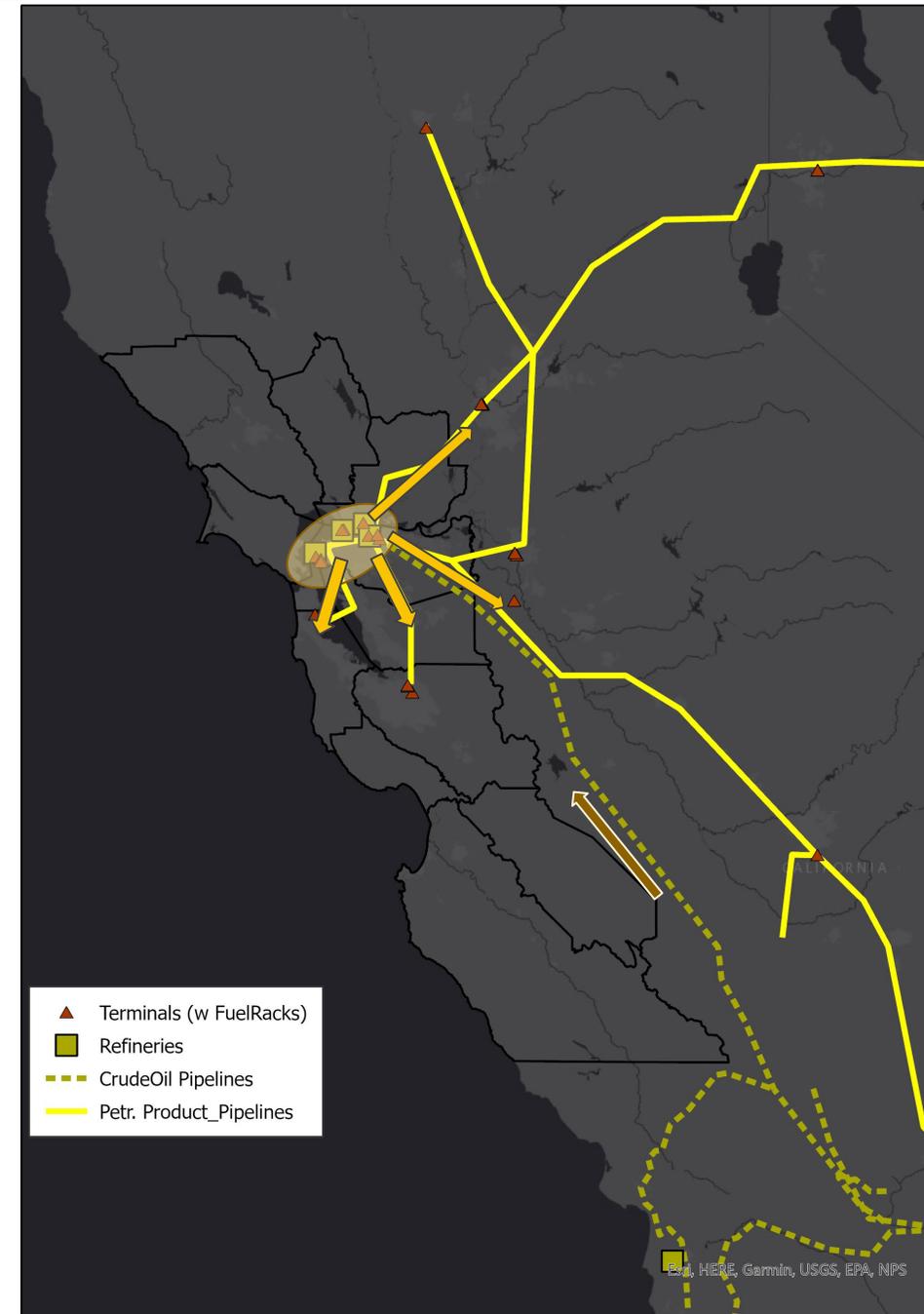
Confluence: Food

- Major truck flows into and out of Central CA on I-5, SR-90, I-80.
- Concentrations of distribution centers in Sacramento, Tracy
- Grocery distribution truck flows into Region on I-580, I-80, 152, within Region on I-680, I-880 and US-101.



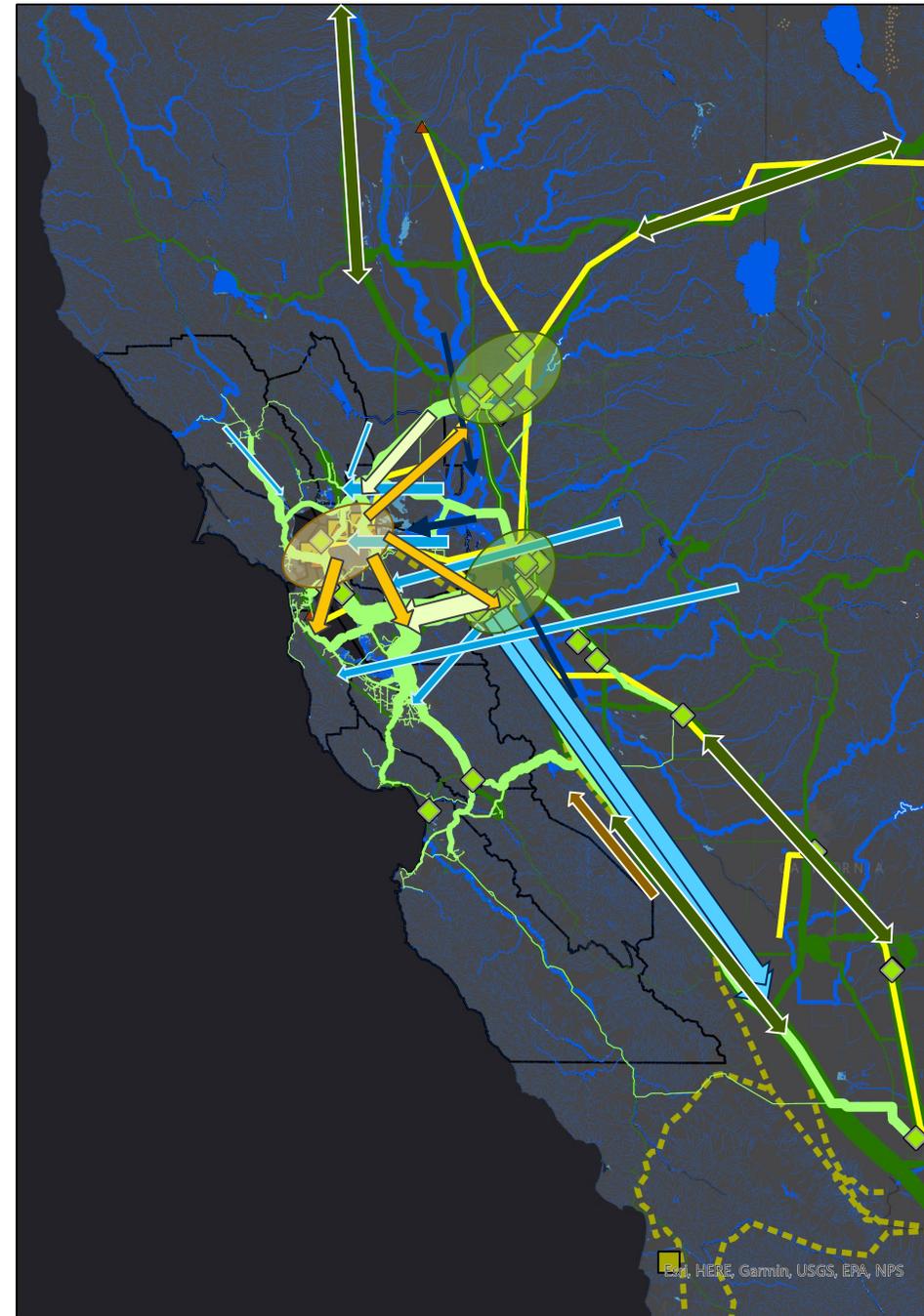
Confluence: Fuel

- Crude oil flows North by pipeline in I-5 corridor (or by tanker vessel to Ports along the Bay).
- Cluster of refineries along water in Richmond, Rodeo, Martinez, Benicia.
- Refineries move petroleum products (gasoline and diesel) through pipelines to terminals serving most of Central CA, NV.



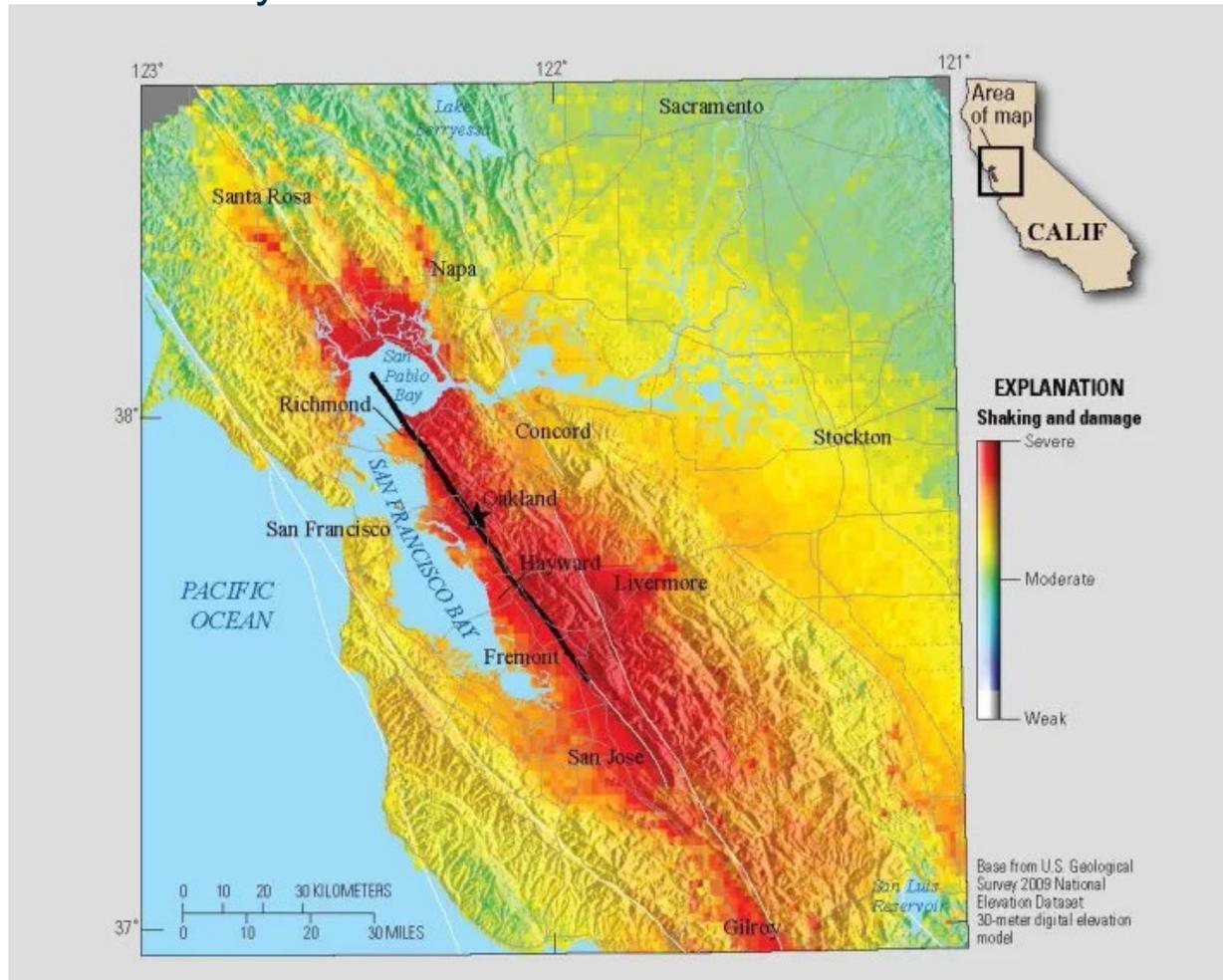
Confluence: Synthesis of all the key flows

- I-5 South corridor – Major water projects, food trucking, crude oil.
- SR-90 – Food trucking, petroleum product pipeline
- I-80 (Sacramento) – Food trucking, grocery DCs, product pipelines
- Tracy – Grocery DCs, grocery trucking, water projects
- I-680 & Rt 4 – Fuel refineries, water projects, grocery trucking

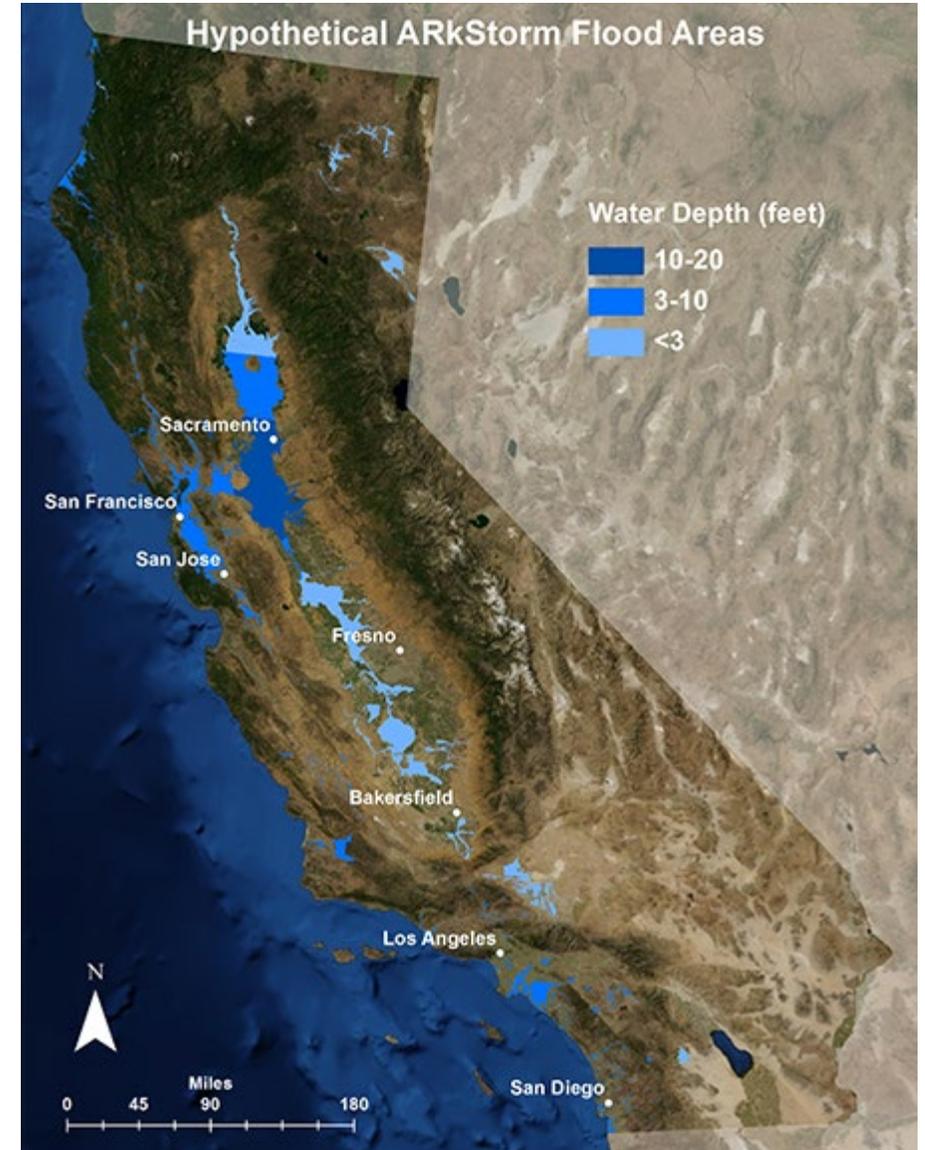


Catastrophic scenarios can happen

Hayward fault



ARkStorm – 1000-yr atmospheric river event



Source: USGS

Review – What you learned, where to go next

- **Know your region's flows** - High-level picture for the most critical water and food flows for you understand (as informed by private sector).
 - Know where to focus attention during disasters, ask better questions
 - Refine your understanding of flows at a finer geographic scale
- **Know your key players** –
 - Engage the key players at **Regional Community Lifelines Council (RCLC)**
- **Know what you can do** - Expectations for EMs by food, water sector
 - Consult the **Bay Area Supply Chain Resilience Playbook** (to be developed)
- Still coming...

- **Know your most important population vulnerabilities** – **Supply Chain Considerations for People with Disabilities Report** to be developed

Regional Community Lifelines Council

- Develop and improve public/private collaboration for disaster preparedness across the Bay Area region.
- Understand inter-dependencies to enhance lifeline planning, restoration, and reconstruction.
- Develop regional plans and procedures for lifeline restoration and recovery following a major disaster event in the Bay Area.
- Share information about recovery plans, projects and priorities.

Wrap-Up and Next Steps

- [UASI Resource Library](#) (link in chat)
 - Reminder of resources available, suggested readings
 - Recording will be available
- Complete the post-seminar assessment
- BA-UASI closing notes



Next Seminar is on **January 25, 2023 – Vulnerable Populations, Non-Traditional, Pharmaceutical, and Non-Human Commodity Flows**

Link to register is in chat