Session 1 – Where we've been

Chino Basin Watermaster—History, role, and successes in addressing water quality

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Rockets, Fireworks and Flares Superfund Site: EPA groundwater cleanup in the Rialto-Colton Basin

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The DTSC investigation of perchlorate in groundwater in the eastern Chino Basin

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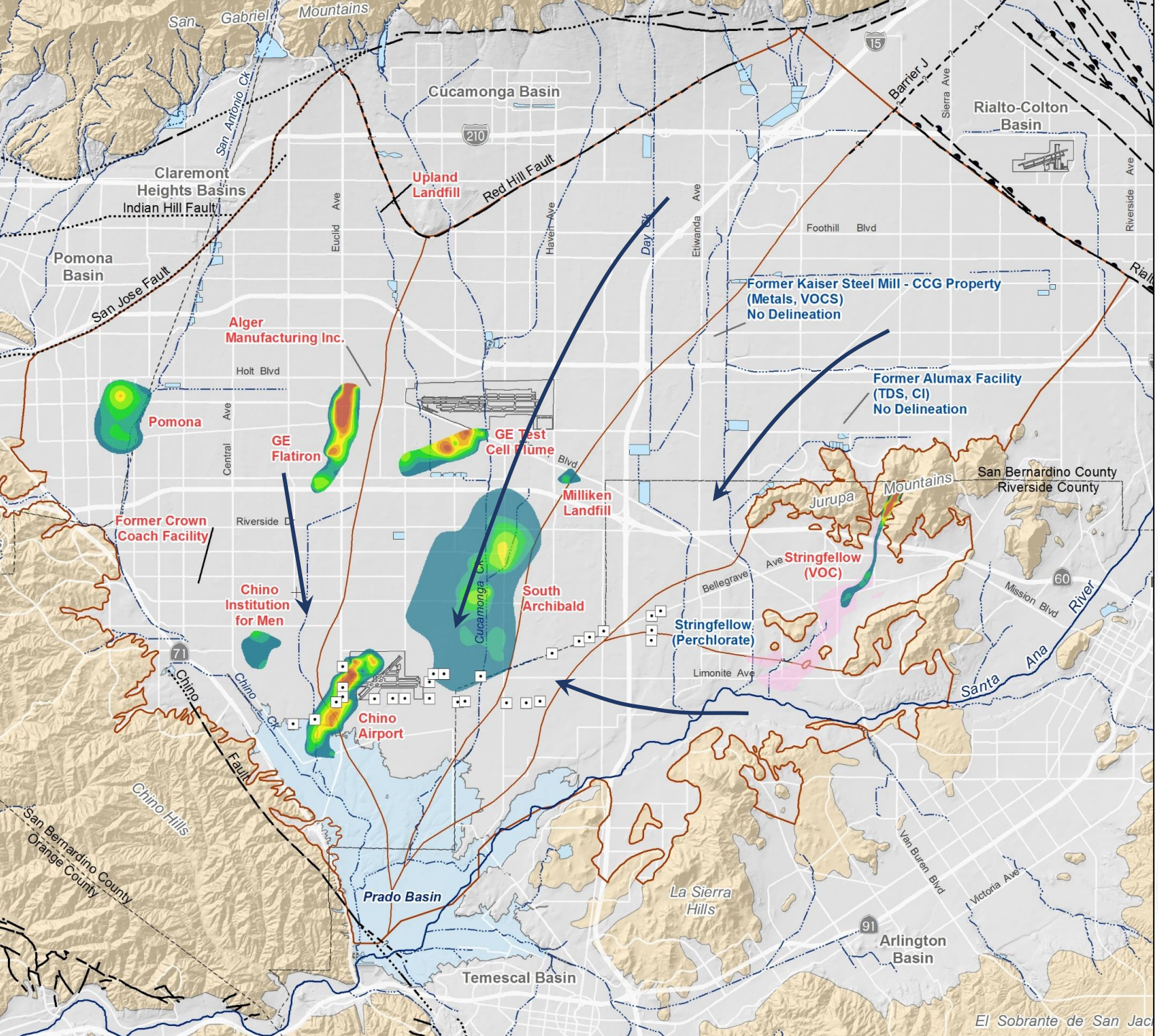
Chino Basin Water Quality Colloquium
May 2, 2019

CHINO BASIN WATERMASTER

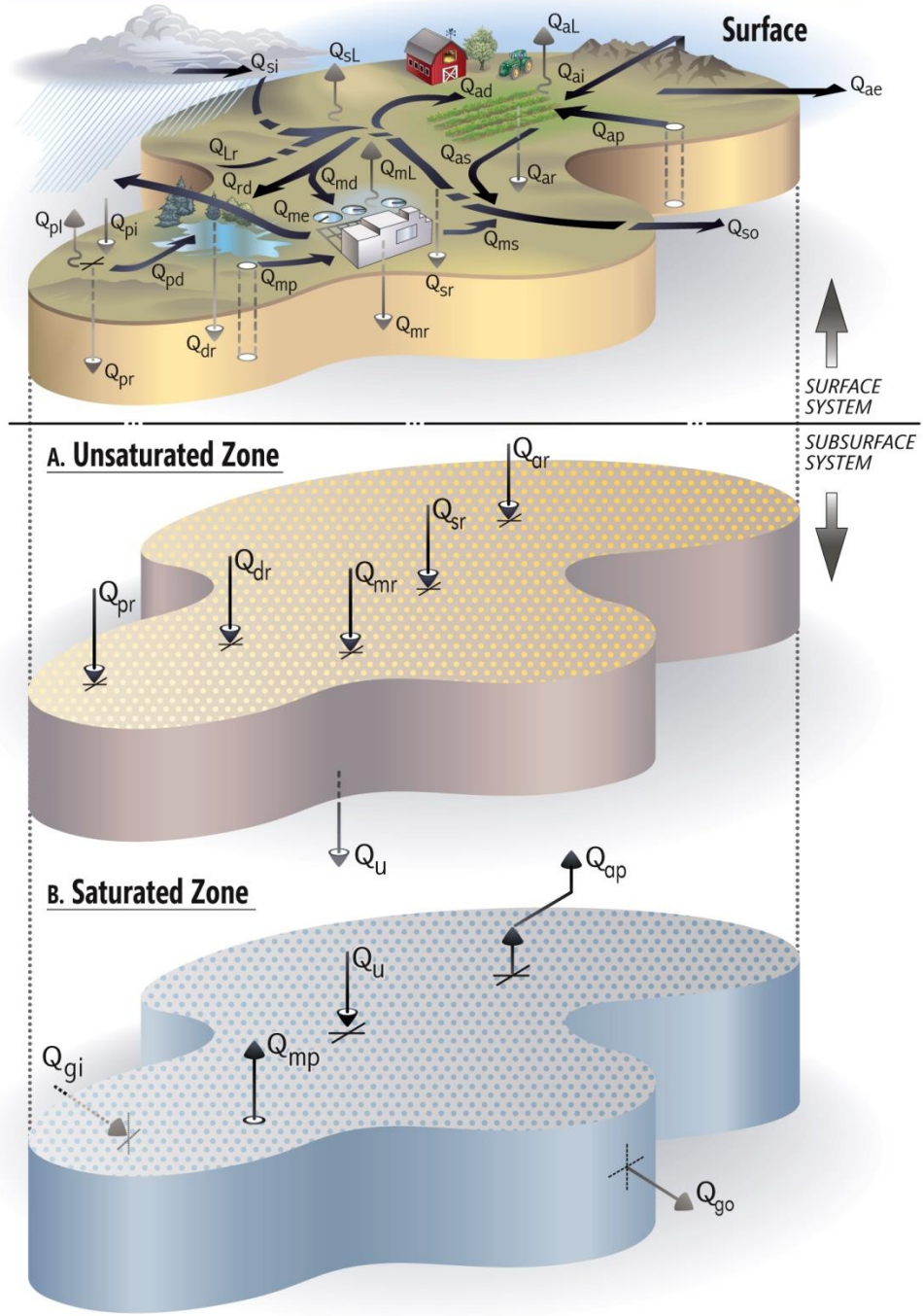
HISTORY, ROLE, AND SUCCESSES IN ADDRESSING WATER QUALITY

- History of water-quality monitoring prior to the Optimum Basin Management Program (Pre-OBMP)
- OBMP goals and program elements related to water quality
- Watermaster accomplishments during OBMP implementation related to water quality
- Use of Watermaster modeling tools in investigations related to water quality



HYDROLOGIC BUDGET

FIGURE 4 – 1



PRE-OBMP HISTORY

PRIOR TO 2000

1940s to 1978 (pre-Judgment) monitoring entities

- California Department of Water Resources (DWR)
- San Bernardino County Flood Control District (SBCFD)
- 1969 Santa Ana River Judgment participants
- Dischargers under Regional Board orders
- Municipal water suppliers
- Agricultural water suppliers

1978 to 2000 (post-Judgment) monitoring by Watermaster

- Monitoring by DWR and SBCFD ceases
- Metropolitan conducts first comprehensive Title 22 survey
- Watermaster begins sampling program in agricultural areas during 1990s

Optimum Basin Management Program

A New Focus on Water Quality

Chino Basin Judgment

- Established pumping and storage rights
- Gave Watermaster discretionary authority to develop OBMP including both water quantity and **quality** considerations

OBMP and Peace Agreement

- Court Ordered – February 1998
- OBMP was completed in August 1999
- Peace Agreement and Program EIR were completed in July 2000
- Four OBMP Goals

  Goal #2: Protect and enhance water quality

OBMP Program Elements

A New Focus on Water Quality

Comprehensive Groundwater Monitoring – PE 1

Comprehensive Recharge Program – PE 2

Water Supply Plan for Impaired Areas – PE 3

Subsidence Area Management Program – PE 4

Regional Supplemental Water Program – PE 5

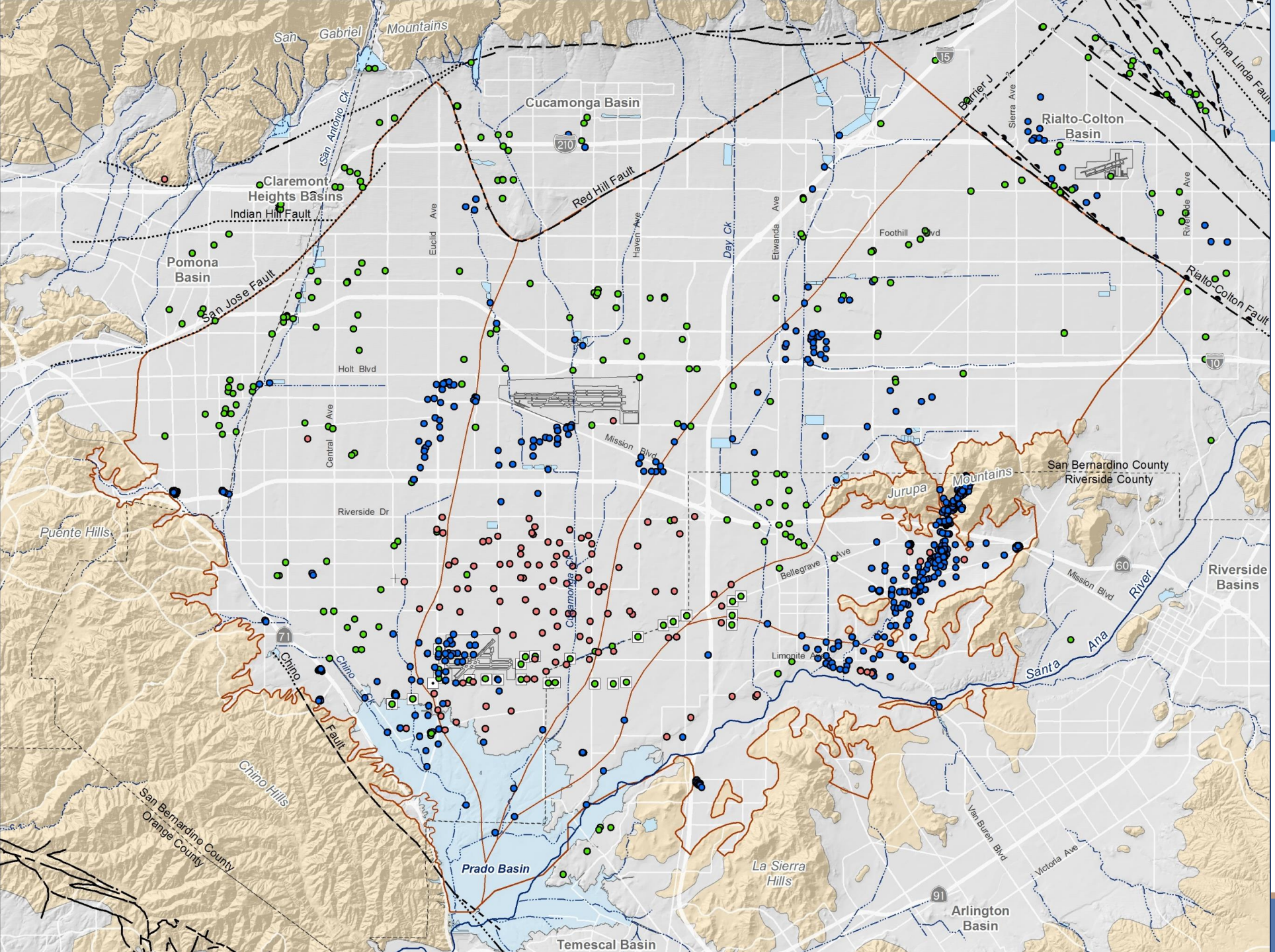
Cooperative Programs with Regulators – PE 6

Salt Management Program – PE 7

Storage Management Program – PE 8

Storage and Recovery Program – PE 9

Groundwater-Quality Monitoring Program



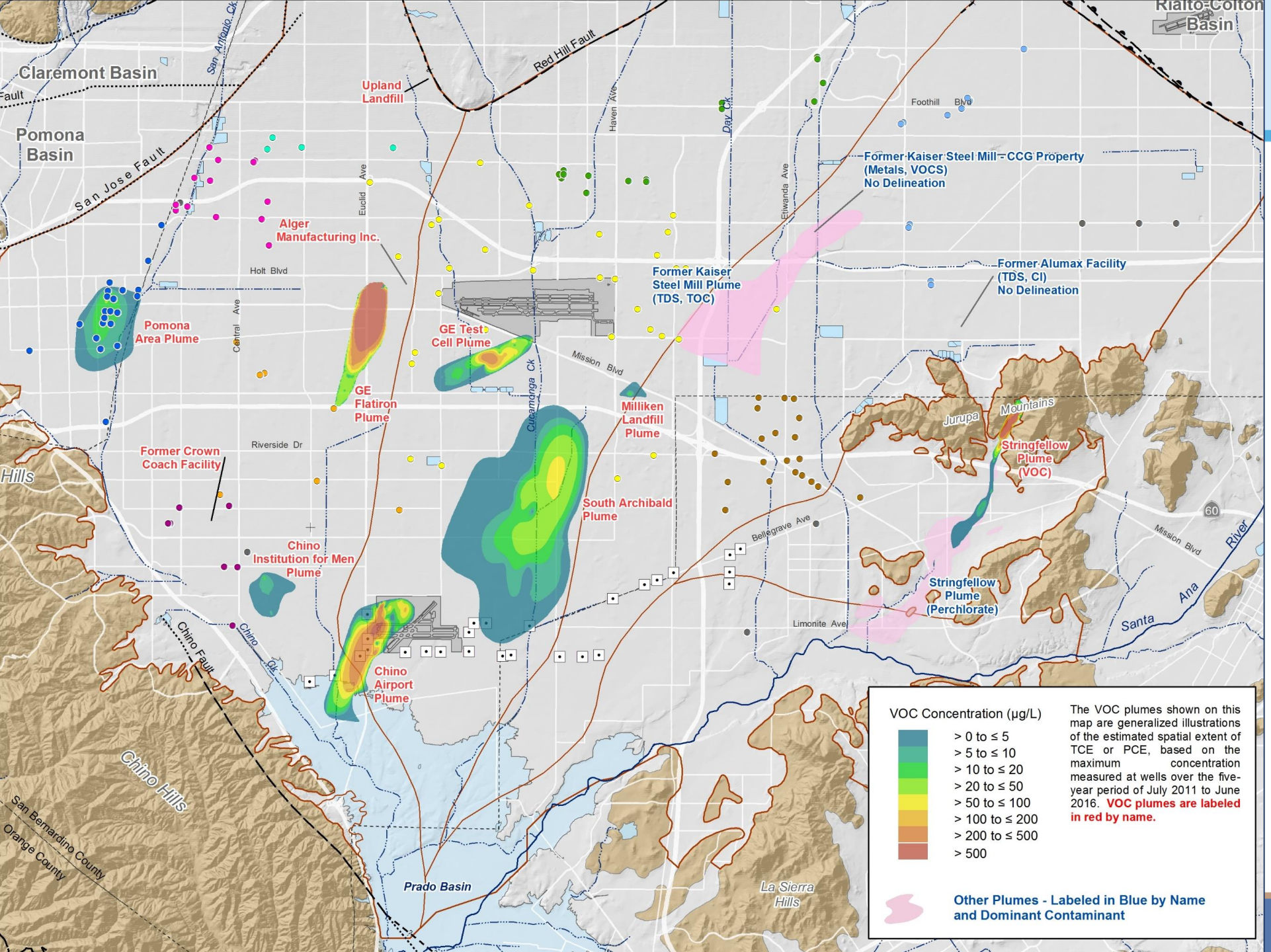
Wells with Groundwater-Quality Monitoring Data During June 2013 to June 2018

- Monitoring (987 wells)
- Municipal (260 wells)
- Private (116 wells)
- Chino Basin Desalter Wells

Objectives:

- Characterize point and non-point contaminants
- Assist Regional Board
- Track changes in water quality under the OBMP
- Support programs:
  - Hydraulic control
  - Ambient water quality recalculation

Early OBMP Activities and Successes



Monitoring:

- Collected and compiled all available data
- Well canvass and sampling program focused on southern Chino Basin
- Delineation of point-source contaminant plumes

Water Quality Committee:

- Purpose: to review water quality conditions; develop cooperative strategies to improve water quality conditions
- MZ-3 investigation

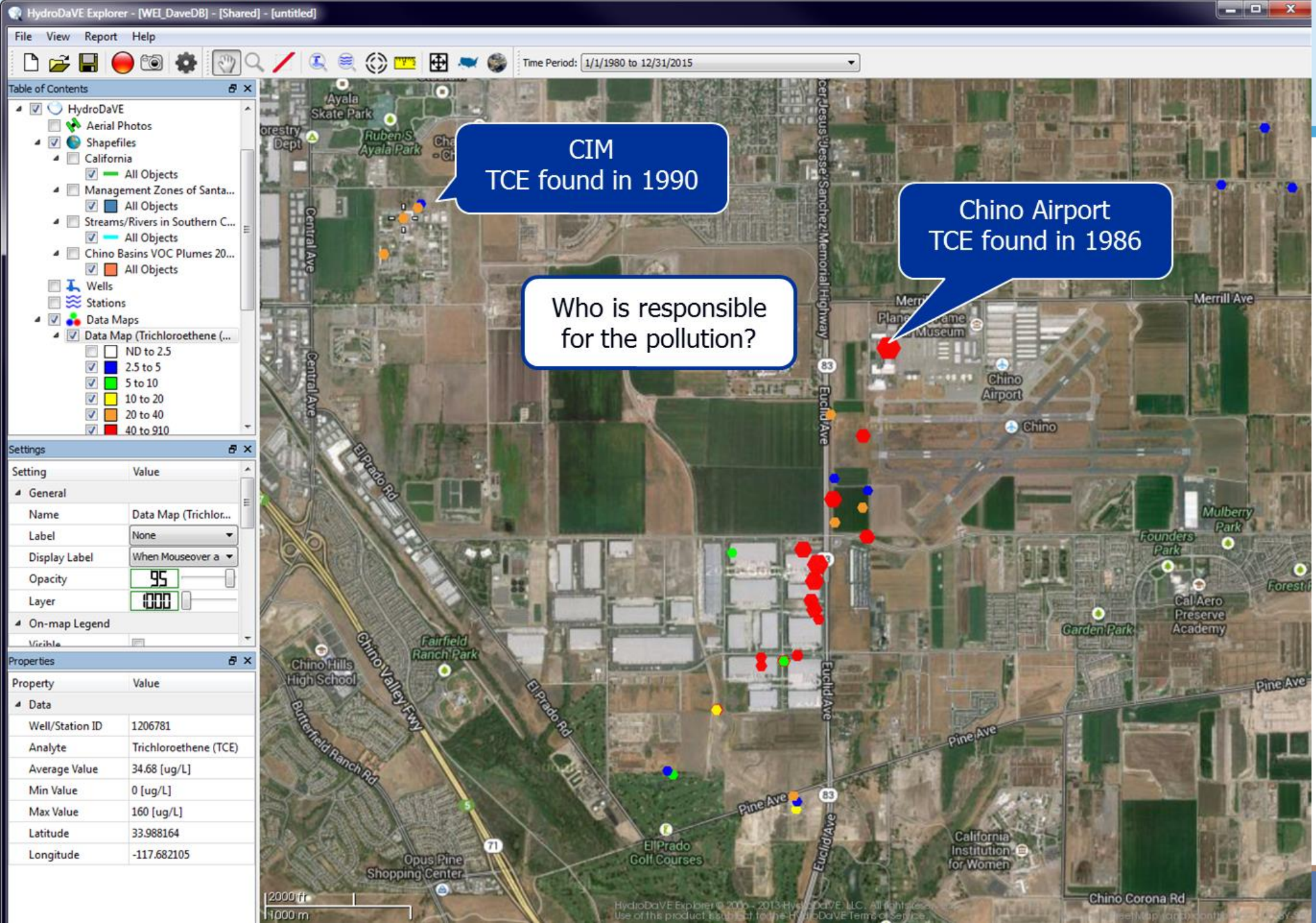
WATERMASTER'S WATER-QUALITY DATABASE

Water-Quality Database → HydroDaVE℠

- Data is checked and uploaded into a centralized, relational database
- Data export in multiple formats to support data requests, data deliverables, mapping, charting, and modeling
- Data is accessible via an online user interface
- Produces explanatory data graphics → Facilitates greater insight. Solves problems.

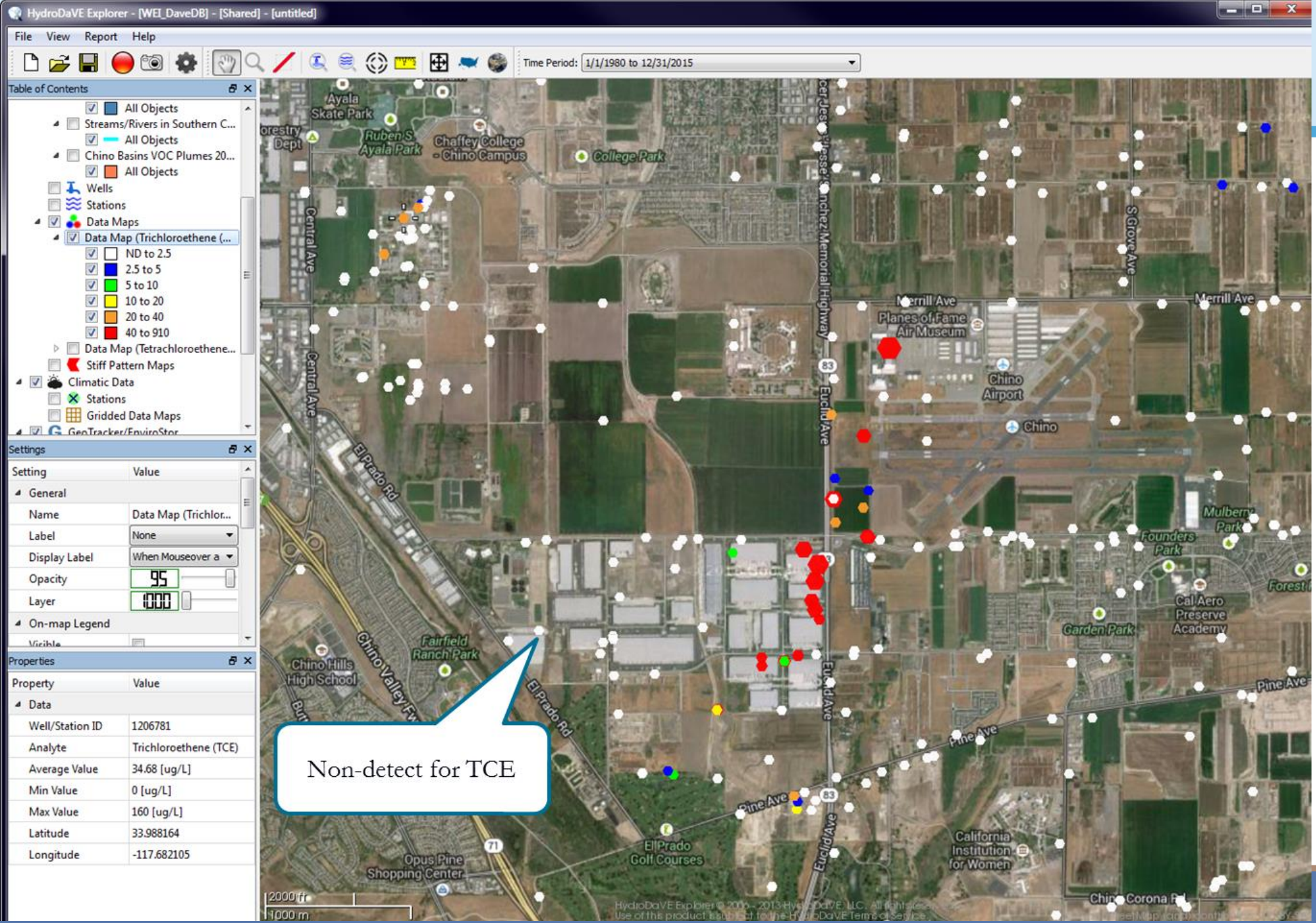
  Example: Off-site contaminants at the Chino Airport

Mapping & Analysis of Groundwater Quality



TCE was discovered in groundwater in the 1980s in the vicinity of the Chino Airport. The owners of the airport initially hypothesized that a documented release of contaminants to the northwest at a state prison may have been the source of the contaminants in the vicinity of the airport.

Mapping & Analysis of Groundwater Quality



The Chino Basin Watermaster compiled all groundwater-monitoring data in the area into HydroDaVE, and prepared maps of the data in HydroDaVE Explorer (HDX). At many wells located between the airport and the prison, TCE was not detected in groundwater samples, which suggests that contamination at the prison and the airport come from separate sources.

WATERMASTER REPORTING *ON WATER QUALITY*

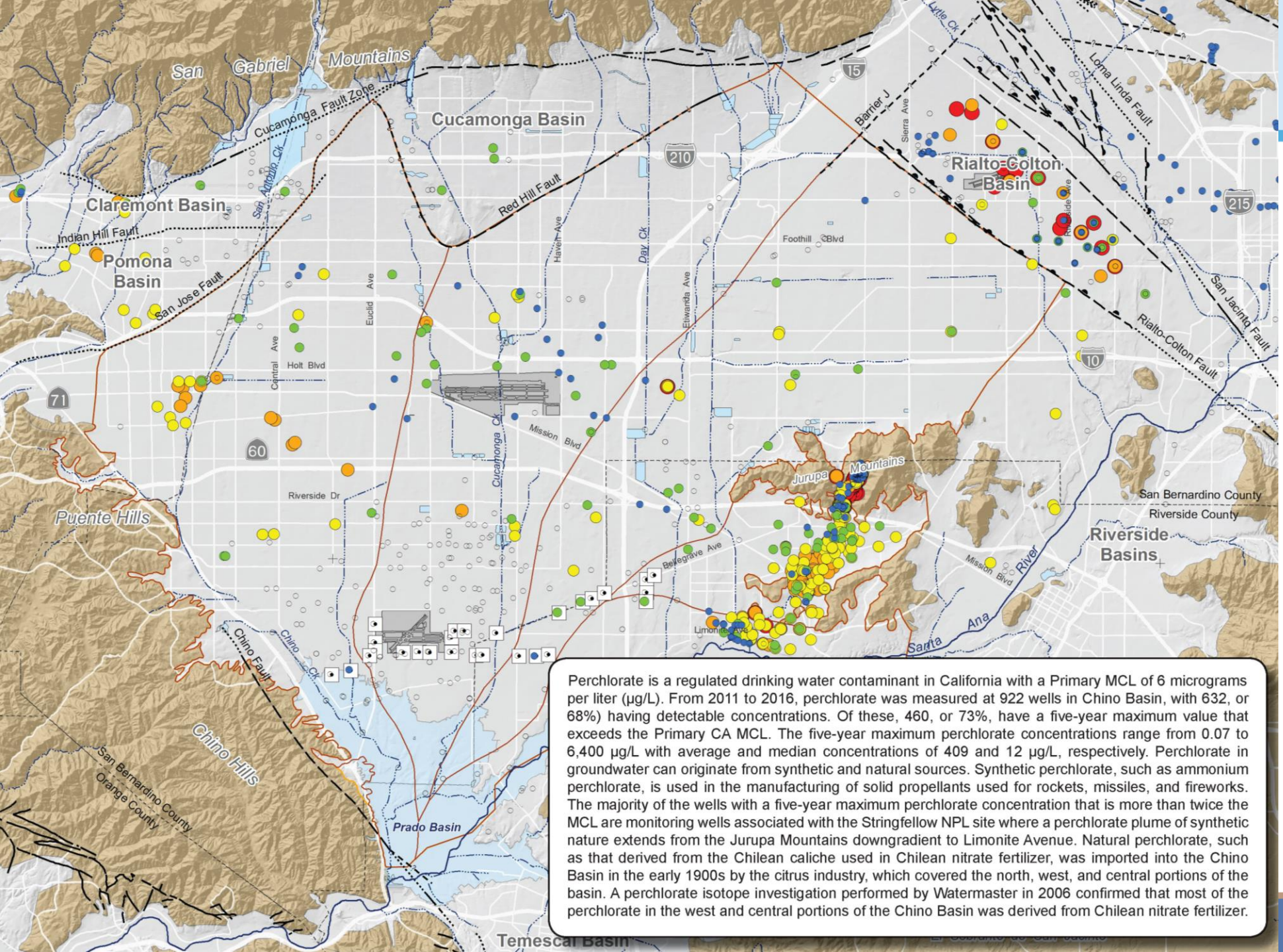
Bi-annual State of the Basin Reports

- Current state (2018)
- Changes the have occurred during OBMP implementation (since 2000)
- Constituents: point-source and non-point-source contaminants

Semi-Annual Status Reports on the Plumes

- Contaminant location, extent, and concentrations (includes map)
- Site history and Regional Board order(s)
- Remedial Action Plan
- Monitoring and reporting
- Recent and upcoming activities

State of the Basin Report
Perchlorate (2011-2016)



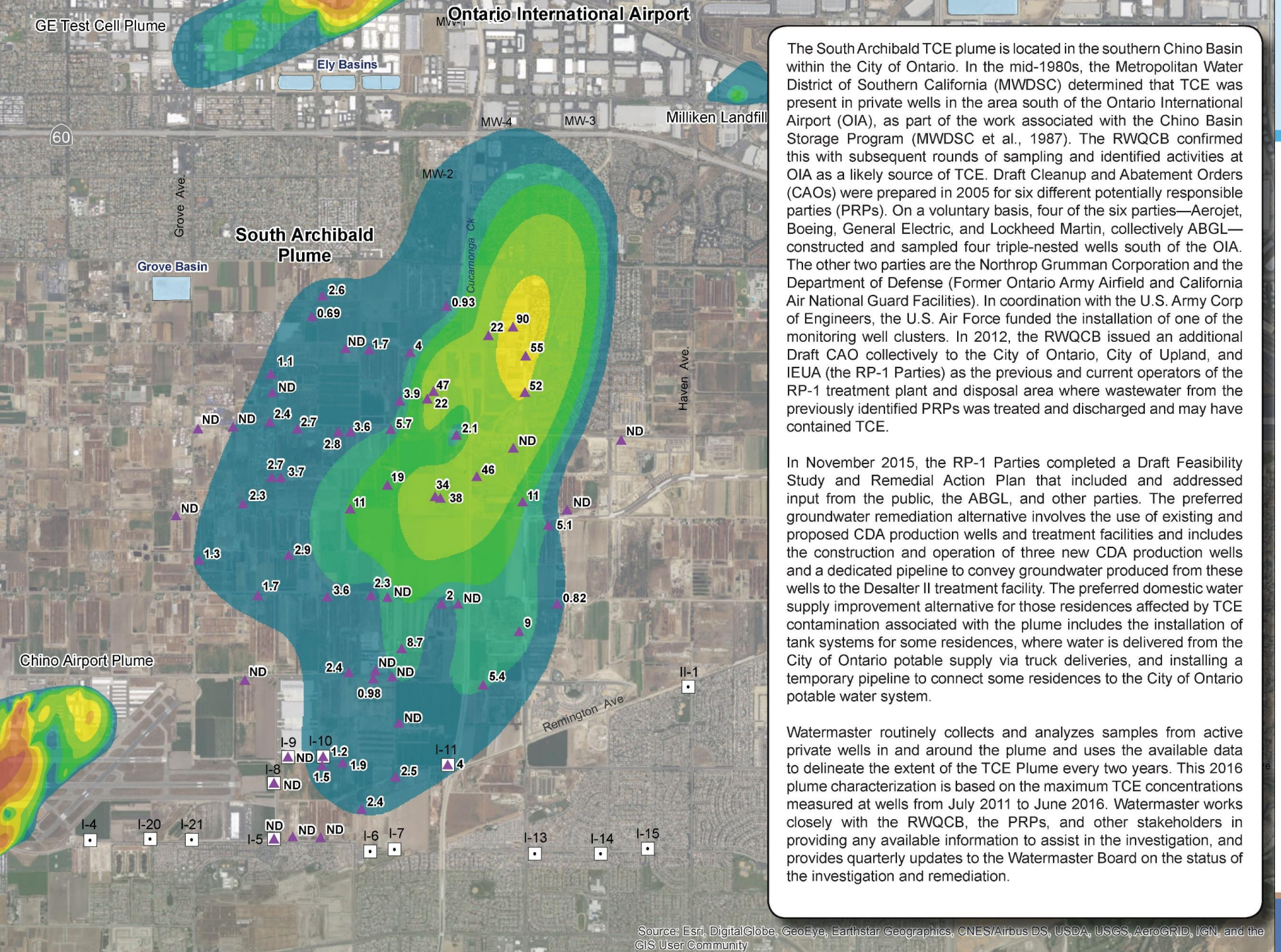
Perchlorate (µg/L)

- ND
- < 3
- 3 - 6
- 6 - 12
- 12 - 24
- > 24

CA Primary MCL = 6 µg/L

Perchlorate is a regulated drinking water contaminant in California with a Primary MCL of 6 micrograms per liter (µg/L). From 2011 to 2016, perchlorate was measured at 922 wells in Chino Basin, with 632, or 68%) having detectable concentrations. Of these, 460, or 73%, have a five-year maximum value that exceeds the Primary CA MCL. The five-year maximum perchlorate concentrations range from 0.07 to 6,400 µg/L with average and median concentrations of 409 and 12 µg/L, respectively. Perchlorate in groundwater can originate from synthetic and natural sources. Synthetic perchlorate, such as ammonium perchlorate, is used in the manufacturing of solid propellants used for rockets, missiles, and fireworks. The majority of the wells with a five-year maximum perchlorate concentration that is more than twice the MCL are monitoring wells associated with the Stringfellow NPL site where a perchlorate plume of synthetic nature extends from the Jurupa Mountains downgradient to Limonite Avenue. Natural perchlorate, such as that derived from the Chilean caliche used in Chilean nitrate fertilizer, was imported into the Chino Basin in the early 1900s by the citrus industry, which covered the north, west, and central portions of the basin. A perchlorate isotope investigation performed by Watermaster in 2006 confirmed that most of the perchlorate in the west and central portions of the Chino Basin was derived from Chilean nitrate fertilizer.

State of the Basin Report
South Archibald TCE Plume



The South Archibald TCE plume is located in the southern Chino Basin within the City of Ontario. In the mid-1980s, the Metropolitan Water District of Southern California (MWDSC) determined that TCE was present in private wells in the area south of the Ontario International Airport (OIA), as part of the work associated with the Chino Basin Storage Program (MWDSC et al., 1987). The RWQCB confirmed this with subsequent rounds of sampling and identified activities at OIA as a likely source of TCE. Draft Cleanup and Abatement Orders (CAOs) were prepared in 2005 for six different potentially responsible parties (PRPs). On a voluntary basis, four of the six parties—Aerojet, Boeing, General Electric, and Lockheed Martin, collectively ABGL—constructed and sampled four triple-nested wells south of the OIA. The other two parties are the Northrop Grumman Corporation and the Department of Defense (Former Ontario Army Airfield and California Air National Guard Facilities). In coordination with the U.S. Army Corp of Engineers, the U.S. Air Force funded the installation of one of the monitoring well clusters. In 2012, the RWQCB issued an additional Draft CAO collectively to the City of Ontario, City of Upland, and IEUA (the RP-1 Parties) as the previous and current operators of the RP-1 treatment plant and disposal area where wastewater from the previously identified PRPs was treated and discharged and may have contained TCE.

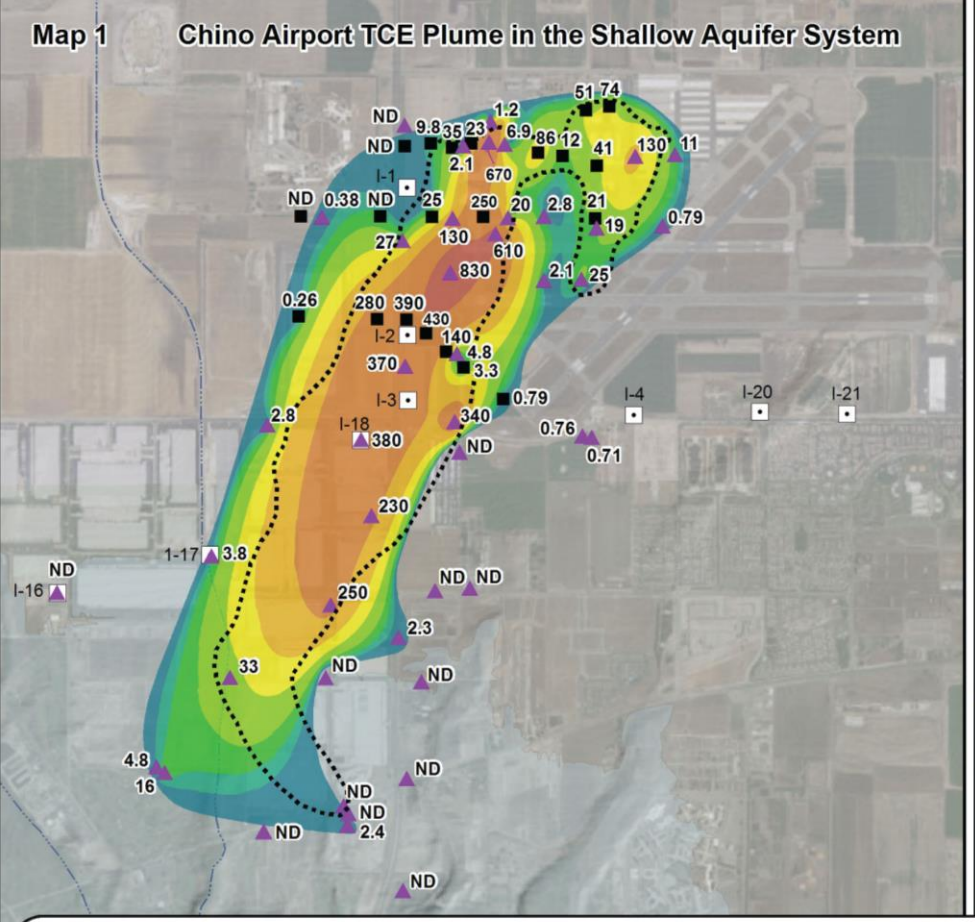
In November 2015, the RP-1 Parties completed a Draft Feasibility Study and Remedial Action Plan that included and addressed input from the public, the ABGL, and other parties. The preferred groundwater remediation alternative involves the use of existing and proposed CDA production wells and treatment facilities and includes the construction and operation of three new CDA production wells and a dedicated pipeline to convey groundwater produced from these wells to the Desalter II treatment facility. The preferred domestic water supply improvement alternative for those residences affected by TCE contamination associated with the plume includes the installation of tank systems for some residences, where water is delivered from the City of Ontario potable supply via truck deliveries, and installing a temporary pipeline to connect some residences to the City of Ontario potable water system.

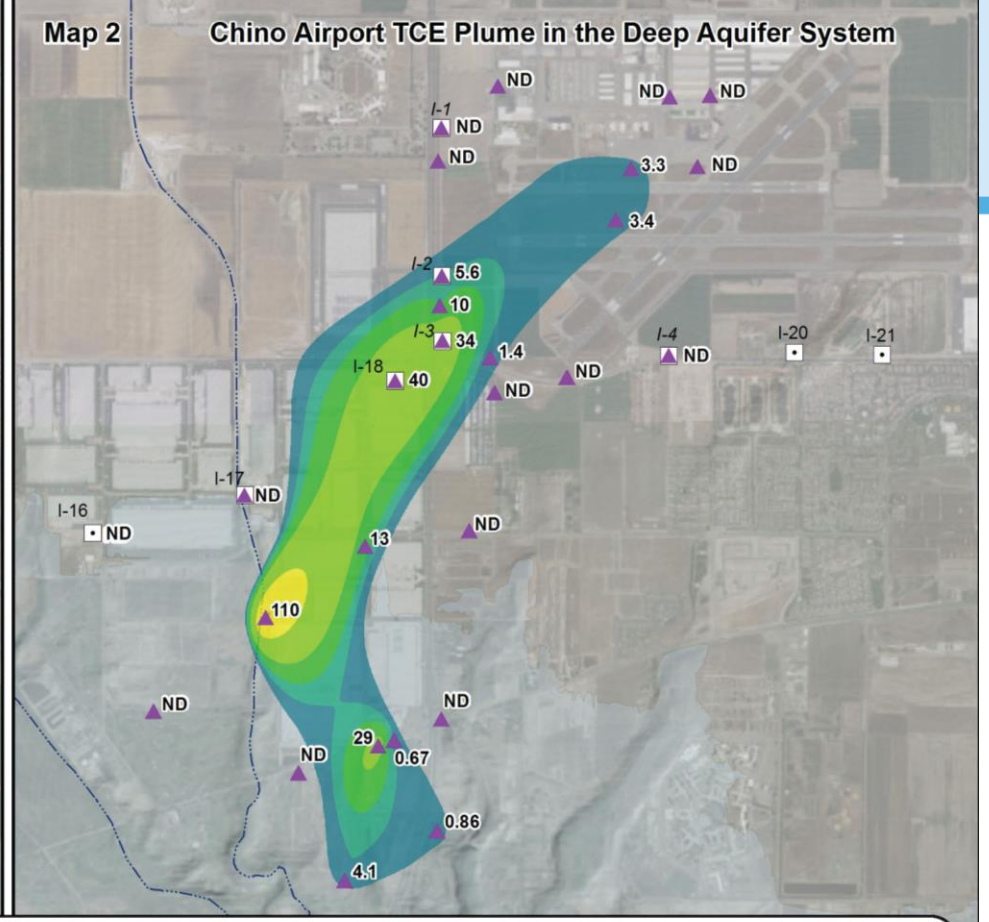
Watermaster routinely collects and analyzes samples from active private wells in and around the plume and uses the available data to delineate the extent of the TCE Plume every two years. This 2016 plume characterization is based on the maximum TCE concentrations measured at wells from July 2011 to June 2016. Watermaster works closely with the RWQCB, the PRPs, and other stakeholders in providing any available information to assist in the investigation, and provides quarterly updates to the Watermaster Board on the status of the investigation and remediation.

TCE Concentration (µg/L)

- > 0 to ≤ 5
- > 5 to ≤ 10
- > 10 to ≤ 20
- > 20 to ≤ 50
- > 50 to ≤ 100
- > 100 to ≤ 200
- > 200 to ≤ 500
- > 500

State of the Basin Report
Chino Airport TCE Plume





VOC Concentration (µg/L)

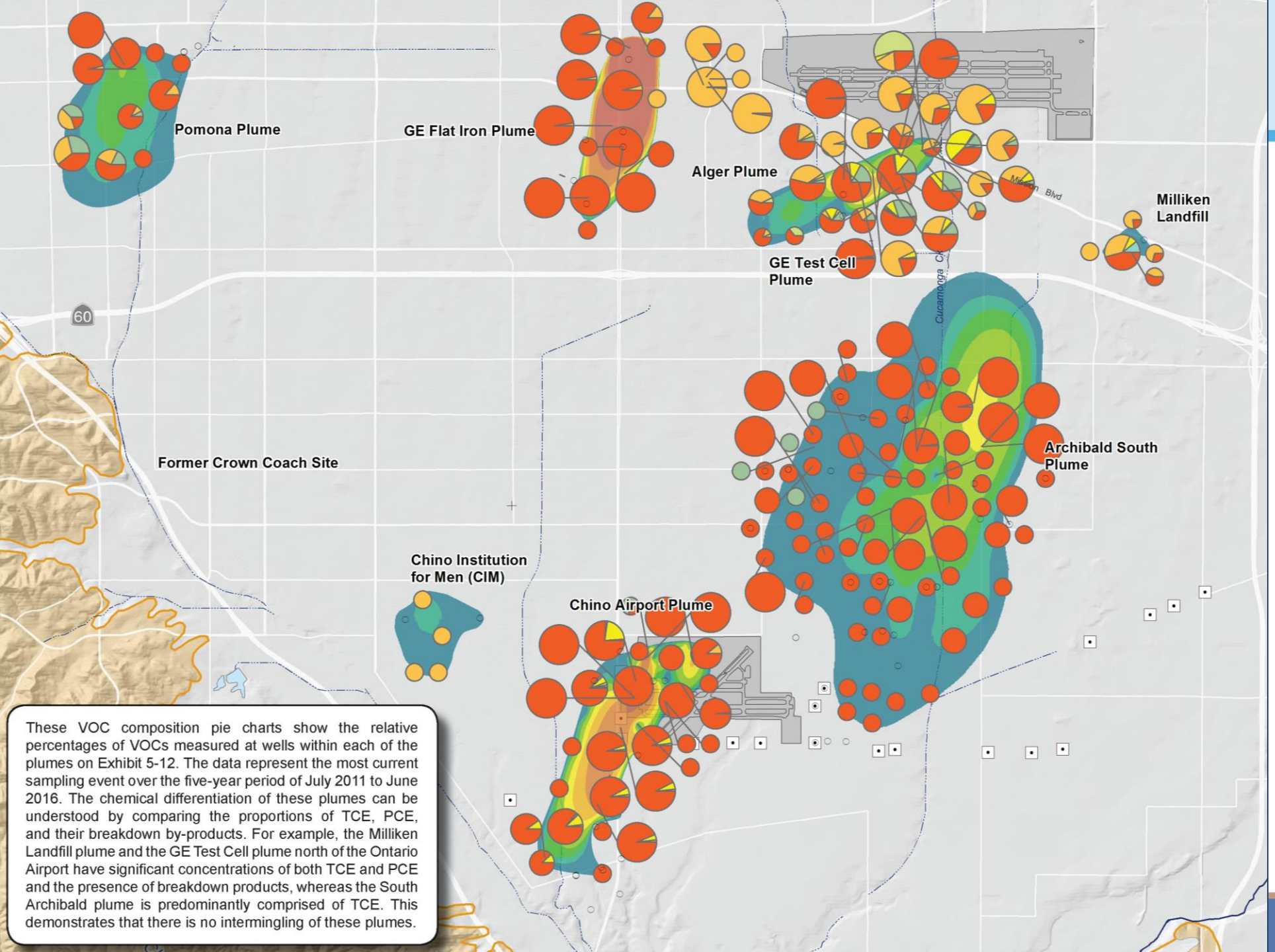
- > 0 to ≤ 5
- > 5 to ≤ 10
- > 10 to ≤ 20
- > 20 to ≤ 50
- > 50 to ≤ 100
- > 100 to ≤ 200
- > 200 to ≤ 500

The Chino Airport TCE Plume is located in the southwestern portion of the Chino Basin within the City of Chino. The County of San Bernardino Department of Airports is identified as the responsible party for the Chino Airport Plume, and the RWQCB has issued CAO No. 90-134 and CAO No. R8-2008-0064, ordering the County to characterize the extent of the plume and prepare a remedial action plan. From 1991 to 1992, ten inactive underground storage tanks and 310 containers of hazardous waste were removed. Since 2003, the County has constructed a total of 75 monitoring wells and conducted extensive investigations to characterize the soil and groundwater contamination associated with the Chino Airport. Recent investigative work included: piezocone-penetrometer tests, vertical-aquifer-profiling (VAP) borings with depth-discrete groundwater sampling, soil-gas probe sampling, high-resolution soil sampling and analysis, real-time data analysis, and three-dimensional contaminant distribution modeling. In August 2016, the County completed a Draft Feasibility Study that identifies remedial action objectives and evaluates remediation alternatives. The recommended remediation alternative is a groundwater pump-and-treat system to provide hydraulic containment of the contamination originating from the Chino Airport.

The County conducts quarterly, annual, or biennial water-quality monitoring and quarterly water-level monitoring at the 75 monitoring wells constructed to date, and characterizes the extent of the plume vertically in multiple cross-sectional views, and laterally in an areal view, using the data collected from their monitoring program. The most recent characterization of the TCE plume prepared by the County was published in 2016 (Tetra Tech, 2016) and is shown here compared to Watermaster's delineation of the plume.

Watermaster collects groundwater-quality data in and surrounding the plume at private wells, monitoring wells, and CDA production wells. The multiple-depth, groundwater-quality monitoring at wells and borings in and to the south of the Chino Airport has allowed for TCE to be characterized horizontally and vertically. TCE has been detected in both the shallow unconfined aquifer system and the deeper confined aquifer system. TCE is more thoroughly characterized in the shallow aquifer system than in the deep aquifer system. Watermaster's plume characterizations are based on the maximum concentrations measured at wells from July 2011 to June 2016.

State of the Basin Report
VOC Composition Pie Charts



Percent of Detectable TCE, PCE, and their Degradation By-Products During the Last Sample

- 1,1,1-Trichloroethane
- 1,1-Dichloroethane
- 1,1-Dichloroethene
- 1,2-Dichloroethane
- cis-1,2-Dichloroethene
- Tetrachloroethene (PCE)
- trans-1,2-Dichloroethene
- Trichloroethene (TCE)
- Vinyl Chloride

- 0.01 - 5
- 5 - 10
- 10 - 20
- 20 - 50
- > 50

- Wells with Non-Detect Results for VOCs During Last Sample Event
- Chino Basin Desalter Well

These VOC composition pie charts show the relative percentages of VOCs measured at wells within each of the plumes on Exhibit 5-12. The data represent the most current sampling event over the five-year period of July 2011 to June 2016. The chemical differentiation of these plumes can be understood by comparing the proportions of TCE, PCE, and their breakdown by-products. For example, the Milliken Landfill plume and the GE Test Cell plume north of the Ontario Airport have significant concentrations of both TCE and PCE and the presence of breakdown products, whereas the South Archibald plume is predominantly comprised of TCE. This demonstrates that there is no intermingling of these plumes.

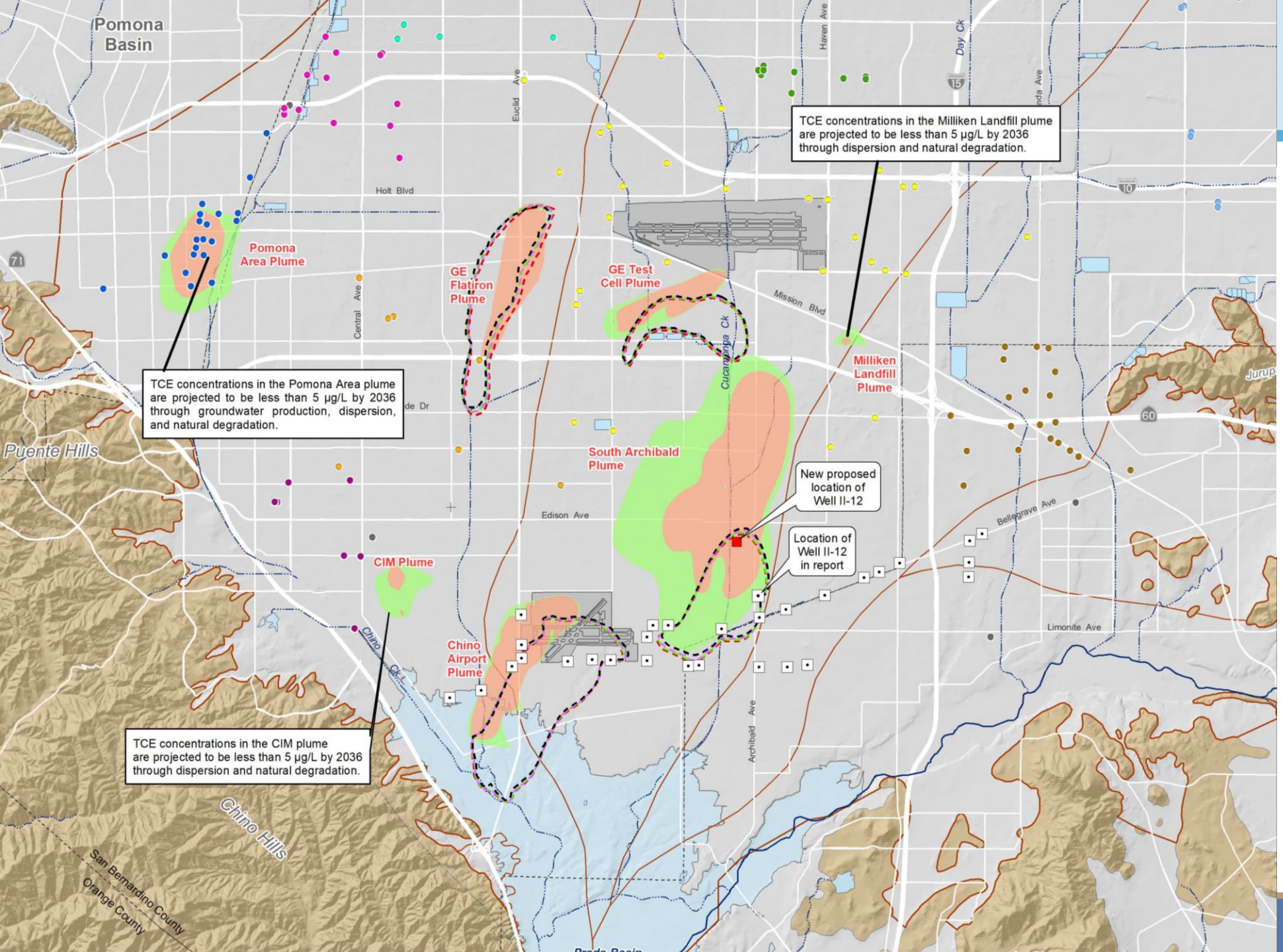
Use of Watermaster Modeling Tools in Investigations Related to Water-Quality

Watermaster models have been improved over time to answer questions related to water quality

Examples of model uses:

- Estimate impacts of groundwater remediation on groundwater levels
- Estimate impacts of storage and recovery programs on movement of plumes
- Solute-transport modeling to support salinity-management planning and regulatory compliance (in progress)

Plume Locations
Storage & Recovery Programs
2036



Estimated Initial TCE Concentration (µg/L)

- 0.01 to 5
- > 5

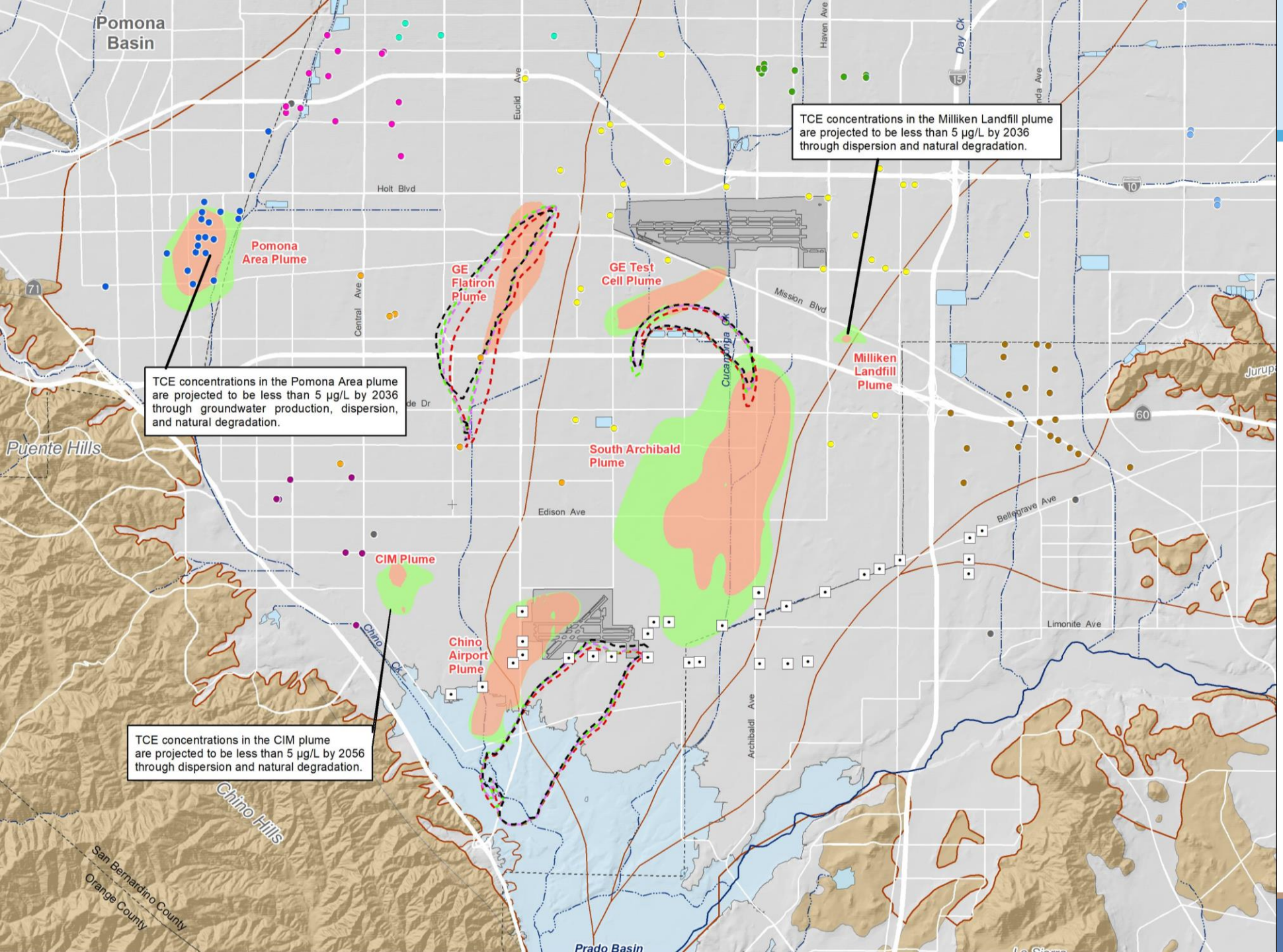
Projected Boundary of TCE Plume in July 2056

- Scenario 1A (TCE > 5 µg/L)
- Scenario 2C (TCE > 5 µg/L)
- Scenario 3B (TCE > 5 µg/L)
- Scenario 4B (TCE > 5 µg/L)

Appropriative Pool Pumping Wells

- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District
- Other Appropriators

Plume Locations
Storage & Recovery Programs
2056



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SUMMARY

Watermaster's role in addressing water quality has expanded and evolved over time, and especially during OBMP implementation

- Monitoring and data management
- Reporting
- Collaboration with regulators
- Modeling

Expect continued evolution of Watermaster's role

Thank you

Chino Basin Watermaster

History, Role, and Successes in Addressing Water Quality

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