Water Quality in the City of Pomona: The Effects of Water Scarcity on an Urban Community

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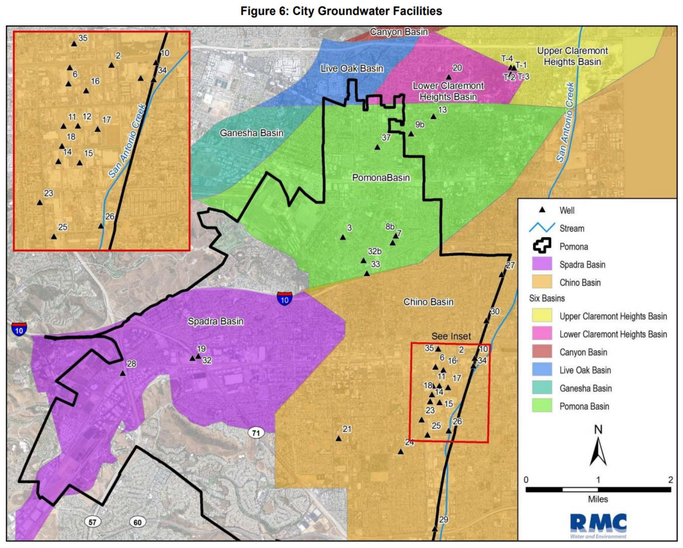
Abstract

As with most cities in Southern California, the City of Pomona has its origins in the agricultural industry. While this economic activity led to an influx of wealth and people, the heavy use of industrial fertilizers has left the region with water quality challenges such as excess nitrate, perchlorates and volatile organic compounds that still pollute the local groundwater and pose a real health risk to the communities. The current solution is use imported water to blend the local groundwater to acceptable levels. With increasing pressure from global climate change and continued industrial-agricultural activity, the sources of imported water are diminishing to a critical point. Southern California must address its water quality challenges without its continued dependence on imported water. The myriad of independent water systems provides yet another obstacle for the state and water authorities to navigate. The technology and public will exist to build the infrastructure needed to solve these challenges but will require time, investment and continued research.

Introduction

Figure 6: City Groundwater Facilities



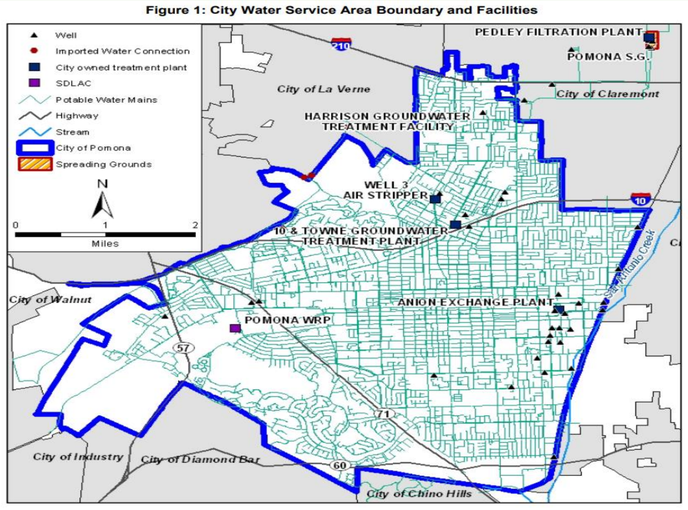
Pomona's water supply comes from 3 different sources: approximately

- **70%** of the water supply is sourced through local ground water from the Chino Basin, Six Basins, and Spadra basin.
- **25%** is imported from either Colorado River via the Colorado River Aqueduct or from San Joaquin Delta in Northern California via the California Aqueduct.
- **5%** is sourced from surface water of the San Gabriel Mountain Range. [1]

Water Infrastructure

- Pomona is a highly urbanized city with a population of over 153,000 [2] and has increasing potable water needs.
- The city projects it will have a demand of 24,038 acre-feet (afy) of water in 2020 [3].

Figure 1: City Water Service Area Boundary and Facilities



- The potable water system has over 421 miles of water mains with over 6,000 fire hydrants. [3]

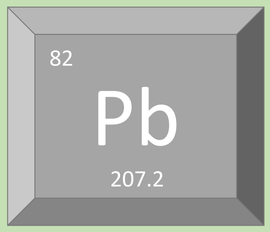
According to the City of Pomona's 2011 Integrated Water Supply Plan, the city operates a potable water system using:

22 storage reserves
15 active booster pumping stations
28 pressure regulating stations
41 groundwater wells
3 imported water connections
2 inter-agency connections
7 water treatment facilities

Water Quality Challenges

Lead does not come from the water treatment facilities itself; rather it leaches from the existing lead piping in houses and businesses. Thus, while the water is free of lead after treatment, it can become contaminated if it remains in a lead pipe and does not flow. The city recommends letting the water out of a tap flow for a minute or so if any piping in the building contains lead [1].

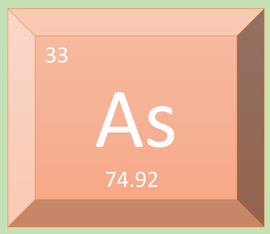
Lead can be filtered out by Reverse Osmosis or simple carbon filters.



Lead

Arsenic enters the groundwater by leeching out of arsenic-containing-rocks. Although naturally occurring, Arsenic is toxic as it has a high affinity for thiol containing biomolecules. Many critical enzymes and subsequent biochemical cascades are therefore targeted [17].

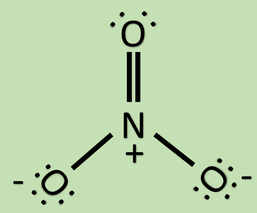
Arsenic can be removed through several common industry techniques such as ion-exchange or reverse osmosis.



Arsenic

Nitrate is an incredibly stable and soluble molecule owed to its heavily resonance stabilized structure. It is most often used in the form of Ammonium nitrate which is a common fertilizer. Nitrates can contribute to hemoglobin being altered to methemoglobin which has a reduced oxygen carrying capacity. While the body has an enzyme (Cytochrome b5 reductase) that can undo the damage, infants are less able to process the methemoglobin and can lead to hypoxia if the nitrate concentration is particularly high [16].

Due to its high solubility and low-reactivity yet charged nature, the main means of removing nitrate is by ion-exchange.



Nitrate

Cryptosporidium is a protozoan, a unicellular eukaryotic parasite. Cryptosporidium can infect humans as well as dogs and cats but is typically not a life-threatening pathogen. The main threat is to immuno-compromised individuals who may not be able to withstand an infection [15].

Normal water filtration systems remove almost all Cryptosporidium but cannot guarantee complete removal. Cryptosporidium is highly resistant to Chlorine and as such boiling and UV light exposure are more effective secondary water treatment techniques.

Cryptosporidium

Results of Water Treatment

- The City of Pomona has addressed 3 of its 4 listed water quality challenges: Lead, Arsenic and Cryptosporidium.
- The City has said Nitrates continue to be its greatest water quality challenge [1]
  - 25 out of 38 of the City's wells were above MCL [1][14]
  - Owed to its agricultural history.
- Perchlorates above MCL [1]
- Volatile Organic Compounds above MCL [1]
- Hexavalent Chromium above MCL [1]

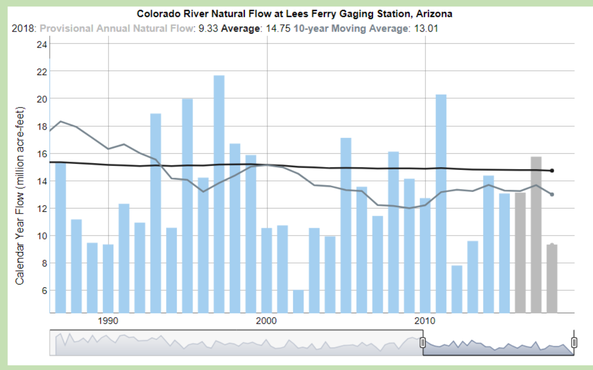
Challenges and Solutions

Nitrates and Perchlorates can be filtered by Ion-Exchange or Reverse Osmosis, there are drawbacks

- Ion-Exchange
  - Facilities are expensive to build and maintain
  - Resin is specific to molecules of similar nature
  - Some wastewater
- Reverse Osmosis
  - Generates substantial wastewater

The simpler and cheaper solution is to blend the water with imported water that does not have such concentrations of these contaminants [8]

Issue with this lies in the decline of sources for the imported water [6]



- Another compounding issue lies in California many, widespread, and independent water providers
- This makes funding for regional infrastructure difficult as each water provider seeks its own interest

Solutions

- Consolidation of smaller providers
- Building of additional Ion-Exchange facilities
- Consideration of Desalination plants as alternate source for blending
- Remediation of local groundwater during plumes
- Research into treatment of waste water

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Illustrations
[P1] Staff. "Figure 1: City Water Service Area Boundary and Facilities." City of Pomona Integrated Water Supply Plan, RMC Water and Environment, 2011, www.ci.pomona.ca.us/mm/pubwrks/water/pdf/IWSP_Final_2011-11-23.pdf.
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