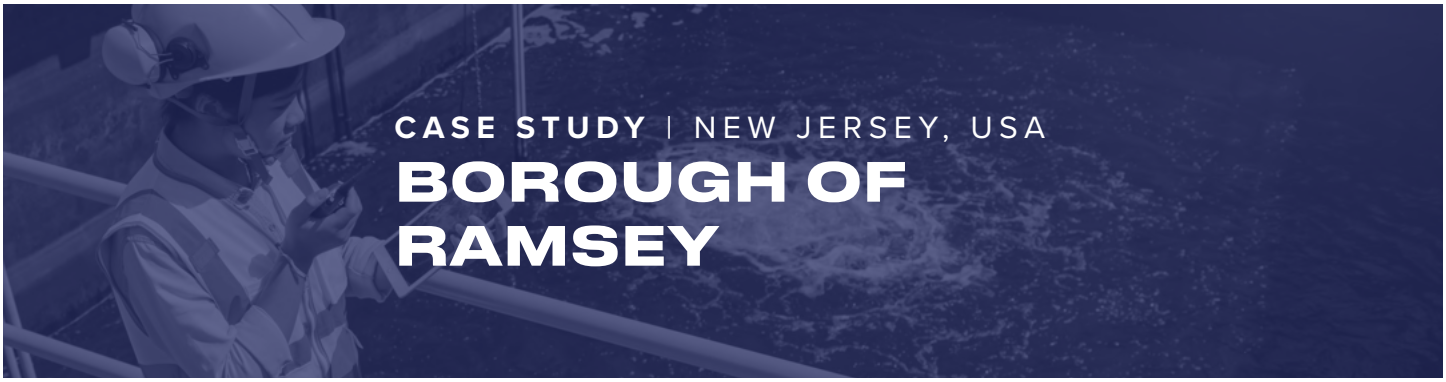

CASE STUDY | NEW JERSEY, USA

BOROUGH OF RAMSEY

SITUATION

- The Department of Public Works (DPW) for the Borough Ramsey -- a residential community with a population of 15,200 – operates fourteen groundwater wells to supply an average 1.77 million gallons (6,700 m^3) of drinking water per day to 5,600 customer connections. The Community's supply of ground water is backed up by an interconnection to a private water utility.
- During 2007 and 2008, the Borough installed modular arsenic treatment systems at six of the community's 14 well sites to maintain compliance with the State's progressive standards for the maximum allowable level of arsenic in drinking water – five parts per billion (ppb) – half of that set forth in the U.S. Environmental Protection Agency's National Primary Drinking Water Regulations.
- The six systems used multi-cartridge filter housings with proprietary, disposable arsenic media cartridges, fulfilling the smaller footprint required by the well sites in exchange for a higher frequency of media replacement, maintenance, and operating costs.

COMPLICATION

- In November 2018, the manufacturer of the proprietary arsenic filter cartridges announced plans to discontinue production, leaving the municipality with an 18-month supply of cartridges.
- Unfortunately, the configuration of the existing arsenic systems did not allow for a simple change of media. While the discontinued system offered a smaller footprint in exchange for a higher frequency of media replacement (disposable cartridges), the best available alternatives offered a lower frequency of media replacement, maintenance, and operating costs in exchange for a larger footprint – one the existing buildings could not accommodate.
- Analysis and selection of a solution to replace the discontinued arsenic adsorption media began immediately with the goal of having all six well sites operational by summer 2020.
- The optimal solution was determined to be from AdEdge Water Technologies – a ChartWater™ Center of Excellence – with six completely new, arsenic treatment systems housed in 40-foot (~12.2 m) ISO containers to replace the existing treatment systems – selecting CO_2 pH adjustment and Bayoxide E33® GFO adsorption media to remove arsenic.
- With the design of the new systems well underway, ongoing water quality testing revealed the presence of perfluorooctanoic acid (PFOA)[1] in two community wells – one of the many synthetic compounds commonly referred to as PFAS – with concentrations greater than 14 parts per trillion (ppt) limit proposed by the New Jersey Department of Environmental Protection.

RESOLUTION

- AdEdge water treatment experts took on the challenge to incorporate PFAS treatment into the containerized designs already in progress. As with the arsenic media, the goal was to provide a solution flexible enough to accommodate multiple solutions well into the future.
  - Of the best available treatment options[2] – granular activated carbon (GAC), anion exchange resins (IXv), and reverse osmosis (RO) – GAC and RO were not viable due to site considerations and other constraints.
- With IX resin selected, the team re-designed the treatment process for the two containerized systems – fitting all the equipment into a 53-foot (16.15 m) long container, the largest with a capacity of 170 gpm (~644 liters/minute). See figure 1.
- The AdEdge team incorporated a creative approach on resin selection across multiple vessels using a

SELECTION CRITERIA / PROJECT OBJECTIVES

A small physical footprint.	A non-proprietary equipment solution capable of using a variety of treatment media to accommodate changes in the availability, price, and performance of product.	Reduced operating and maintenance costs.	Installed and operational before the existing supply of proprietary arsenic cartridges was depleted.

proven resin product already supported by significant field data and trusted by the State, while simultaneously provided the Municipality with the ability to collect data to compare the results of two additional resins in the full-scale application.

- The first multi-contaminant, 170-gpm treatment system using IX resins and Bayoxide E33® GFO media began delivering arsenic and PFOA-free water the Borough of Ramsey in the summer of 2020. The second system was installed and commissioned in early 2021.
- In an ongoing effort to maintain a choice of multiple resins in the future, the Ramsey DPW continues to collect data on the three installed IX resins, comparing the performance and longevity of the two novel resin products to the one already trusted by the State.
- The four containerized Arsenic treatment systems and two multi-contaminant PFAS and Arsenic systems continue to successfully remove contaminants from the community's water supply. Given the high capacity of IX resins, several years are required for date to establish the relative performance of all three installed IX resins.

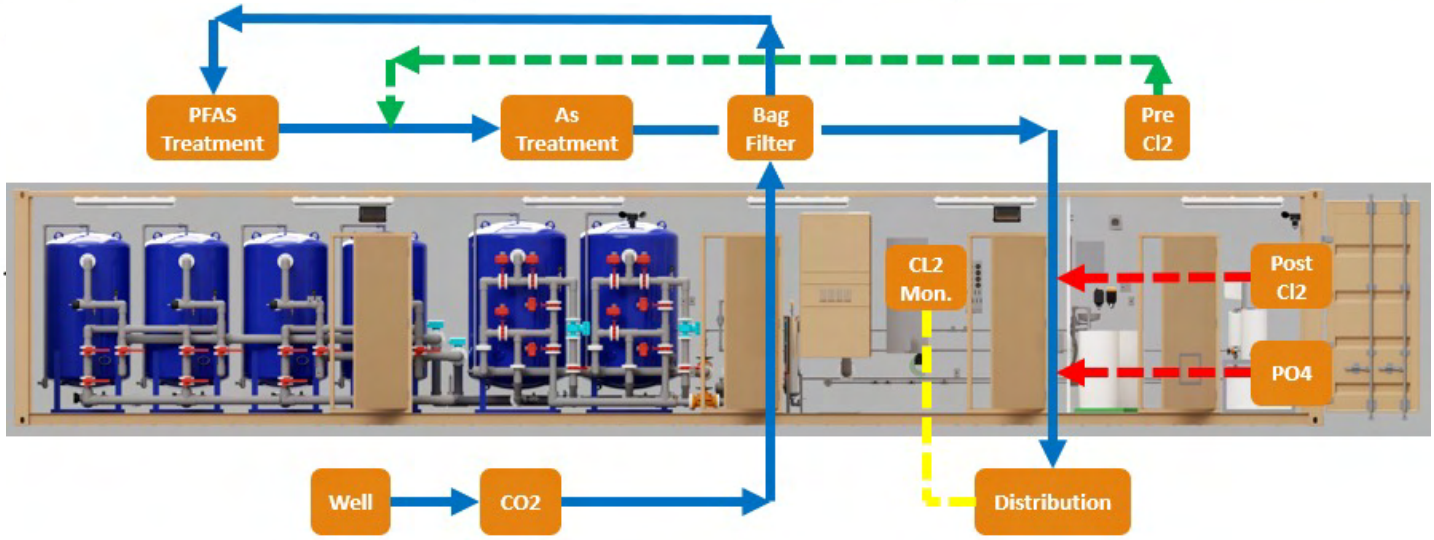

Figure 1. Containerized, multi-contaminant Treatment WaterPOD System. While the available, primary treatment technologies are each effective in the reduction of PFAS compounds, many sites will require multiple processes and treatment steps to address other contaminants in addition to PFAS. Prior to the discover of PFAS in two well sites, the treatment trains for arsenic removal were already designed to fit within 40-foot-long containers, with neither site capable of accommodating additional containers. To fit the new arsenic treatment systems and chemical feed equipment within the physical site constraints, AdEdge used 53-foot-long (≈16 m) containers and re-organize the equipment inside to accommodate the new IX treatment systems for PFOA removal. The resulting treatment train and equipment design addresses the specific treatment needs, site requirements, and project objectives – providing a flexible, non-proprietary system with a small footprint and lower operating and maintenance costs to deliver clean, compliant water to the community.

ECONOMIC/OPERATIONAL

- A non-proprietary solution capable of using a variety of treatment media to accommodate changes in the availability, price, and performance of various media and anion exchange resins.
- Reduced operating and maintenance costs.

SOCIAL/COMMUNITY

- Improved water quality resulting from the safe removal of pervasive, bio-accumulating, contaminants from the community's drinking water.

ENVIRONMENTAL

- Reduced Waste – elimination of the disposable arsenic media cartridges.

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[1] PFOA is one of many synthetic organofluorine compounds collectively known as per- and polyfluoroalkyl substances (PFAS). PFAS and PFOS (perfloluorooctane sulfonic acid) are known to persist in the environment and are commonly described as persistent organic pollutants, also known as "forever chemicals."

[2] At the time of this case study, various types of novel adsorptive media had also been found to effectively remove PFOA – achieving up to 99 percent removal; however, published results for these media were limited to batch tests at bench scale. Today, FLUORO-SORB and other proven solutions are available – with ChartWater's AdEdge Center of Excellence having considerable experience, expertise, and data on the performance of a variety of adsorptive.