

## **Project Number**

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## **Characterizing Microbial Water Quality in Reclaimed Water Distribution Systems**

### **Principle Investigators:**

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### **Objectives:**

The objectives of this project were to (1) characterize the nature and extent of water quality deterioration in reclaimed water distribution systems, including microbial fouling, regrowth, impact to the end user, and impact on reuse and other related regulations; (2) identify pertinent water quality issues in relationship to degradation as it is conveyed to reuse customers; (3) develop general guidance for use by reclaimed water utilities in identifying and assessing problems; and (4) provide options for controlling regrowth including regulating detention time, flushing, and optimization of disinfectants.

### **Highlights:**

The final report includes a summary of state reclaimed water regulations and federal guidelines, and other related regulations. The research team conducted seven reclaimed water utility case studies, which included a 12-month field monitoring program that documented treatment plant effluent and distribution system water quality. They also conducted sampling for biofilm growth and pathogens and pathogen indicators (e.g., *Cryptosporidium*, *Giardia*, enteric viruses, coliphage, and bacteriophage). Three of the case study utilities demonstrated the use and benefits of hydraulic and water quality modeling. The research team put together a final report that provides general guidance for use by reclaimed water utilities in assessing and solving potential problems.

### **Results/Findings:**

The literature review revealed a wide array of end uses for reclaimed water including landscape and recreational grounds irrigation, agricultural crop irrigation, commercial uses, industrial processes, toilet flushing, water features such as fountains, construction activities, firefighting, and preserving stream flows and wetlands. Water reuse criteria varies considerably among states, although some similarities exist in the states that have extensive reuse experience, such as Arizona, Florida, and California. Generally, filtration of secondary wastewater effluent is required, followed by disinfection. Most utilities did not report any microbial problems, but approximately 25% had problems with related issues, such as clogging of sprinkler heads and odors.

In the seven case studies conducted for this project, the most common problem encountered was loss of disinfectant residual in the distribution system. The maintenance of a minimum of 0.2 mg/L chlorine throughout the distribution system, or greater depending on site specifics, is recommended as a fundamental mitigation strategy. *Cryptosporidium* and *Giardia* were detected in both treatment plant effluent and at sampling points in the distribution systems. *Cryptosporidium* was found more often in plant effluent (prior to distribution) and *Giardia* was more commonly detected in the distribution system.