

## 5. Scenario Development

During the February 27, 2015 team exercise, City staff and AECOM defined as many possible contamination scenarios that they could envision that might explain the TC and EC results from the January 26, 2015 event. The investigation started with a focus on the January 26, 2015 event as this event provided the most recent and complete data set, including interviews with staff and new audits of current procedures. The scenario development and analysis approach used for the January 2015 event was then applied to the May 2014 and October 2013 events as best as the data allowed.

The team first considered if a single point-source might have caused the event, including:

- The failure of a single back-flow preventer or air relief valve;
- Localized hydraulic surge/surface water contamination;
- Cross connection (from industry, private wells, etc.);
- Contamination originating in one of the major pumping stations or from the water treatment plant; and
- Distribution system maintenance operations.

The team next considered if simultaneous multiple point-source contamination sites caused by a system-wide hydraulic event could result in the TC and EC results observed on January 26, 2015. Such an event would include a hydraulic surge (short-duration rapid increase/decrease in pressure caused by an emergency pump shut-down or a valve being rapidly closed), or some other system-wide decreases in water pressure on that day. Scenarios considered included:

- Hydraulic surges resulting in multiple point-source contaminations at points of integrity loss in the distribution system (DS) (flooded air valve pits, DS leaks, faulty back-flow preventers, etc.);
- System-wide DS contamination due to biofilm growth, dislodged by a surge in pressure or flow; and
- System-wide disturbance of sediment in pipes that harbored microbial contaminants.

The team then considered if there were any other possible causes of the January 26, 2015 event that were not related to the quality of water in the distribution system, but were rather related to the sampling and analysis processes. These scenarios included:

- Faulty sample collection:
  - Poor sample location (aerator, swivel handle faucet, unsanitary surroundings, etc.);
  - Poor sample collection technique (hands not washed, dirty conditions in sample cooler, dropped caps during sampling, inadequate flushing prior to sampling, poor disinfection of sample tap, etc.); and
  - Intentional contamination of the samples.
- Faulty sample analysis:
  - Contamination of sample within the laboratory;
  - Failure to follow standard process for sample handling and analysis;
  - Improper hold-times prior to analysis;
  - Improper incubation times; and
  - Intentional contamination of the samples.

The team next revisited the possible scenarios listed above to see if the list above was exhaustive, and concluded that it was, but left open the option of discovering additional possible scenarios as the assessment progressed.