

3.0 FLOW ISOLATION AND CCTV INSPECTION

Flow isolation and CCTV inspection were performed to identify and confirm infiltration sources in three areas designated priority infiltration catchment areas in the Phase 1 Part 1 CSO Control Plan report. Flow isolation was performed in Catchment Areas 3, 4, and 7 between April 20, 2006 and April 28, 2006 and follow up flow isolation was performed June 13, 2006, and CCTV inspection was performed between May 23, 2006 and September 5, 2006, by ADS Environmental Services (ADS).

Flow isolation identifies infiltration flow from a pipe segment on a manhole by manhole basis. Flow isolation was performed on all sanitary sewer pipe segments in the priority catchment area. Based on the results of the flow isolation, pipe segments with higher infiltration flows are selected for CCTV inspection. CCTV inspection allows the location of individual flow sources within these segments to be pinpointed, viewed and assessed.

Based on the available GIS mapping data, Earth Tech estimated 71,000 linear feet (LF) of sanitary sewer pipe would be flow isolated in the 3 priority infiltration areas, Catchment Area 3, 4, and 7. In addition for budgeting purposes, Earth Tech estimated approximately one-half or 35,000 LF of the flow isolated pipe would require CCTV inspection.

Flow Isolation Results

- A total of 67,856 linear feet (LF) of pipe was flow isolated in the three priority infiltration catchment areas. The length of pipe inspected in each Catchment Area as measured in the field is as follows:
 - Catchment Area 3 – 32,362 LF
 - Catchment Area 4 – 21,409 LF
 - Catchment Area 7 – 14,085 LF
- The total infiltration flow observed in the three priority Catchment Areas during the initial flow isolation measurement was approximately 105,120 gallons per day (gpd). It is noted that the months of March and April 2006 were extremely dry with record low precipitation. Based on the results, further flow isolation measurements were postponed. In May and June, significant wet weather occurred and instantaneous flow measurements were restarted and completed on June 13, 2006.

- The additional budget for flow isolation was used to perform additional dye testing in the priority inflow areas.

CCTV Inspection Results

- A total of 96 pipe segments were selected for CCTV inspection totaling approximately 23,600 linear feet of sanitary sewer pipe within the three priority infiltration areas.
- Given the age of the sanitary sewer collection system, the system is in fair condition with defects consistent with other systems of similar age and construction.
- Approximately 525 separate defects were observed in the sewer main line pipe and the service connections with a majority considered minor. Note that many lines had multiple defects and a small number of pipes had no observed defects.
- Approximately 100 of the defects will require immediate remediation to prevent a loss of sanitary sewer service or to eliminate a potential loss of service and are outlined in detail in the technical memorandum.
- Based on the limited infiltration flow and defects observed in the CCTV inspections, the remaining budget for CCTV inspection was used to perform additional dye testing in the priority inflow areas.

Rehabilitation Recommendations

Based on the results of the flow isolation and CCTV inspection, the three priority sewer catchments contain infiltration sources that do not contribute significant volume of infiltration to the sanitary sewer system, but further deterioration could result in a failure of sewer service. Remediation recommendations for the defects observed were organized into two categories.

- Short Term Remediation
- Long Term Remediation

Short Term Remediation

Short term remediation was further subdivided into three groups as follows:

- High Priority – Includes broken pipes, sagging pipes, pipes with holes, and pipes exhibiting other signs of imminent failure. The estimated cost to remove and replace pipe sections and line select pipe sections with 4-foot liners is \$778,000, including engineering and contingency.

- Medium Priority – Includes service connections running clear water, service connections with offset joints, cracks in service connection pipes. Since the medium priority defects are on private property in large part or wholly, costs are assumed to be borne by the property owner.
- Low Priority – Including pipe cracks, joint cracks, and leaking joints. The estimated cost to test and seal the defects is \$10,800, including engineering and contingency.

Long Term Remediation

The City should continue to perform CCTV inspection in other areas of the City to identify and repair pipe segments; to extend the service life of the system; to identify sections of the system that have reached the end of its useful service life; to systematically replace or rehabilitate the aging vitrified clay and asbestos cement sewer pipe with PVC pipe and brick manholes with pre-cast concrete manholes.

Conclusions

The quantity of infiltration identified by the flow isolation and follow-up CCTV inspection was approximately 105,000 gallons. This quantity is lower than what was estimated based on the flow monitoring performed in Phase 1 Part 1. Although removal of this infiltration will positively impact the overall capacity of the sanitary sewer system, it has been determined in this phase of work that a majority of the extraneous flow to the collection system is from inflow sources.

Given its age, the sanitary sewer system is in fair condition with a number defects that require attention in the short- and long-term. Rehabilitation of these defects as noted in the previous sections is recommended as part of the City's overall operation and maintenance of the collection system. Although repair of the defects will remove a nominal quantity of infiltration (as presented in Section 9.2), repair of these defects will not have a significant impact on the reduction of CSOs.

Earth Tech recommends that the City address in Phase 2 the recommended high priority rehabilitation that was identified in the Flow Isolation/CCTV Technical Memorandum including broken pipes, sagging pipes, pipes with holes, and pipes exhibiting other signs of imminent failure or detriment to the operation of the collection system. The low and medium priority

rehabilitation should be addressed during future capital improvement projects and collection system operation and maintenance.

A detailed description of the flow isolation and CCTV investigation including procedures and results categorized by defect and by priority catchment area, recommendations, and conclusions are presented in the following Technical Memorandum.