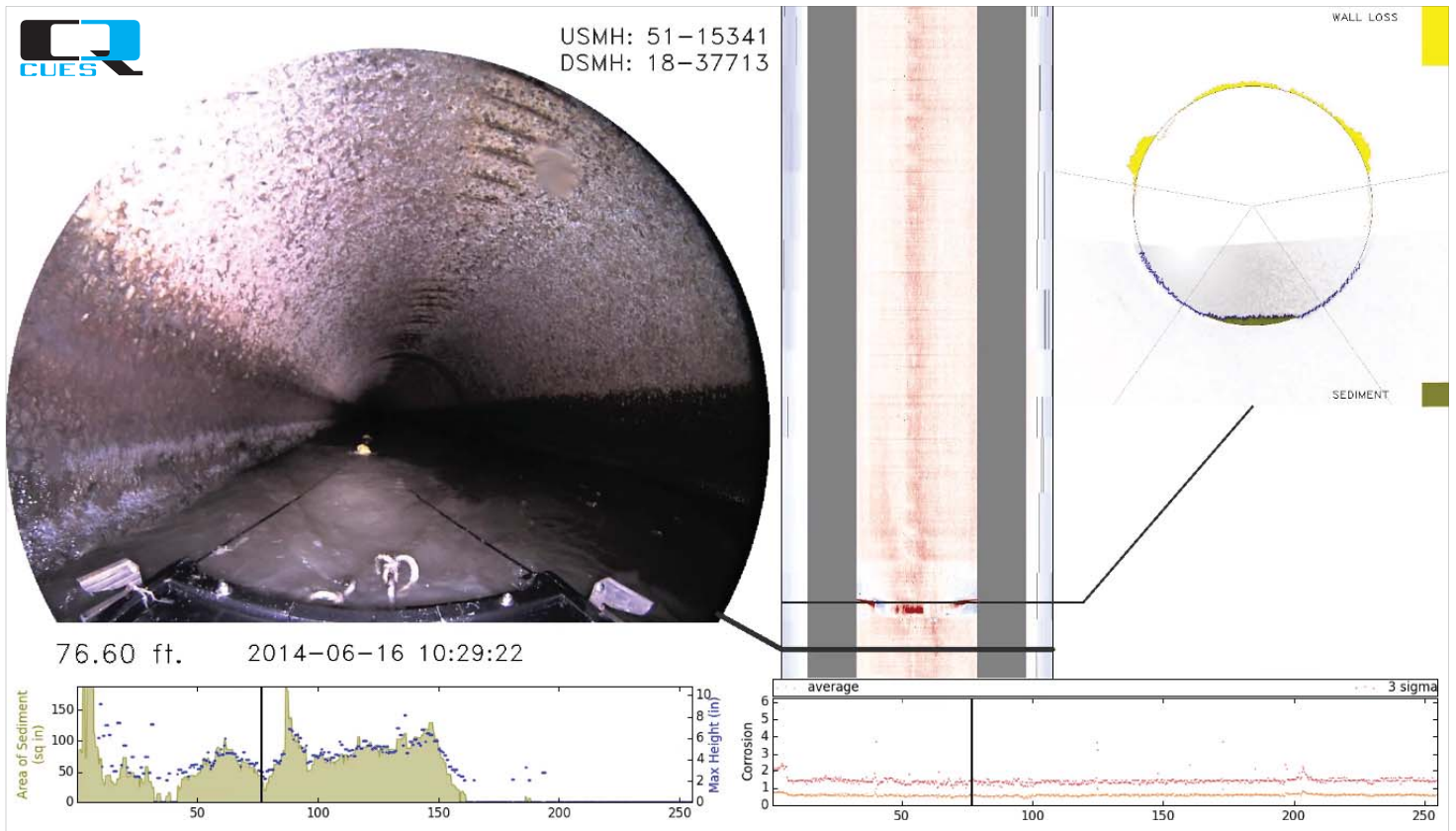


## Multi-Sensor Inspection



- State-of-the-Art LIDAR Inspection
- Registered SONAR/LIDAR
- Fast Report Turnaround
- Live High Definition (HD) CCTV
- Pipes Sizes 24" (600 mm) and Larger
- Dedicated Customer Support

## LIDAR, SONAR, and Live CCTV in Pipes 24" (600 mm) and above



## SOLID FX Specification:

### 1.0 Profiling LIDAR Specification

1. The Light Detection And Ranging (LIDAR) must be specifically configured as a pipe profiling LIDAR that uses time-of-light ranging principle. Specifically excluded is Structured Light (SL) ranging systems that use a camera and laser wand/light ring or other types of scanner with degrading z-axis accuracy as the pipe diameter increases. In addition, the pipe profiling LIDAR must have the following characteristics:
  - a) The LIDAR unit (sensor that is placed within the pipeline) must be protected by a mechanical housing that is specifically designed to survive the rigors of the sewer environment.
  - b) The LIDAR housing shall have IP 67 or better.
  - c) The LIDAR unit shall be "fog" resistance by providing at least 3 multi-echo distance measurements per step. (Note this is an essential feature for obtaining accurate LIDAR data in cold weather, hot condensing, or high humidity conditions where the tendency to induce fog into the pipeline or condensation on the sensor is the greatest)
2. The LIDAR system shall be capable of transmitting continuous, multi-echo range and bearing data from the LIDAR unit within the pipeline to topside viewing station.
  - a) The transmission of the LIDAR data shall be digital.
  - b) The transmission of the LIDAR data shall be continuous.
  - c) The transmitted data shall be logged in digital format for subsequent viewing and analysis operations.
3. The LIDAR unit within the pipeline shall be capable of operation in pipes 24" to 240" (600 mm to 6,000 mm). Also, the LIDAR unit shall have the following properties:
  - a) The range estimation mode of the LIDAR unit shall be time-of-flight.
  - b) The LIDAR unit shall be capable of scanning at least 40 times per second.
  - c) The Near Field Ranging Limit: shall not exceed 0.1 meters.
  - d) The Far Field Ranging Limit shall be at least 30 meters.
  - e) The LIDAR sensor Field of View shall be 270 degree arch.
  - f) The Operating Wavelength shall be near infra red range (not visible to the naked eye) with a nominal value of 905 nm.
  - g) The Angular Resolution shall be 0.25 degrees or better.
  - h) The Accuracy shall be at least +- 30mm at 10 meters.

### 2.0 Profiling SONAR Specification

1. The SONAR system must be specifically designed as a sewer pipe profiling system that uses high frequency sound waves to obtain profiles from the submerged section of the pipes. In addition, the pipe profiling sonar must have the following general characteristics:
  - a) The SONAR unit (sensor that is placed within the pipeline) must be protected by a mechanical housing that is specifically designed to survive the rigors of the sewer environment.
  - b) The SONAR unit shall be depth rated to at least 1000m.
  - c) The SONAR unit shall have integrated pitch and roll sensing.
2. The SONAR system shall be capable of transmitting continuous SONAR data from the SONAR unit within the pipeline to topside viewing station.
  - a) The transmission of the SONAR data shall be digital.
  - b) The transmission of the SONAR data shall be continuous.
  - c) The transmitted data shall be logged in digital format for subsequent viewing and analysis operations.
3. The SONAR unit within the pipeline shall be capable of operation in pipes 24" to 240" (600 mm to 6,000 mm). In addition, the SONAR unit shall have the following properties:
  - a) The Near Field Ranging Limit shall be at least 0.125 meters.
  - b) The Far Field Ranging Limit shall be at least 6 meters.
  - c) The Min Detectable Range shall be at least 50 millimeters.
  - d) THE SONAR unit shall support the following Variable Range Scales:
    - i. 0.125 m, 0.25m, 0.5 m, 0.75 m, and
    - ii. [1-6] m.
  - e) The SONAR unit Step Size shall be at least 0.9 degrees.
  - f) The SONAR unit shall support continuous Train Angles, e.g. Continuous Rotation.
  - g) The SONAR unit shall have an unobstructed Field of View: of 360 degree.
  - h) The SONAR unit shall support a Scanning Speed no smaller than 360 degrees in 1.3 sec.
  - i) The SONAR unit Frequency shall be at least 2.25 Mhz. to ensure the highest possible resolution of resultant data.
  - j) The SONAR unit Transducer Beam Width shall not exceed 1.4 degree conical.
  - k) The SONAR unit Range Resolution shall be at least 1/250 (e.g. 1mm at 250 mm).

## SOLID FX Specification (cont.):

### 3.0 HD CCTV Camera Specification

1. The CCTV camera system must be waterproof, corrosion resistant , and with a protective enclosure specifically designed to survive the rigors of the sewer environment.
2. The CCTV camera system must operate over the temperature range -10 C to 50 C.
3. The CCTV camera system shall contain an imaging sensor that has full resolution color.
  - a. The imaging sensor shall have selectable automatic or manual exposure.
  - b. The imaging sensor shall have a dynamic range of 55db.
  - c. The imaging sensor shall have sensitivity of 1.5 lux at F1.0.
  - d. The imagine sensor shall have selectable automatic or manual white balance.
4. The CCTV System shall be capable of transmitting live video from the CCTV camera within the pipeline to the topside viewing station.
  - a. The transmission of the video signal from the CCTV camera to the topside viewing station shall be digital.
  - b. The digital video signal must be capable of transporting full frame rate video at distances of at least 2000 linear feet (600 linear meters) with out distortion of the topside video image.
5. The CCTV camera shall be high definition with a resolution of at least 2048 x 1536 pixels.
  - a. The frame rate at full resolution must be at least 10 frames/sec.
  - b. The frame rate at ½ (1280 x 1024) resolution must be at least 30 frames/sec.