

# RAP Phase I Stormwater System Internal Survey And Repairs - March/April/May 2024

## Purpose of Survey

The Phase I roadways – Fairmount Boulevard, Sloan Road and Thayer Way – as well as the clubhouse parking lot are to be repaved in the spring of 2024. The firm advising the community on this project, Bustamante Engineers, recommended that an internal inspection be performed of the stormwater system located in and beneath the paved areas to identify any areas in need of repair prior to the repaving.

## Inspection Contractor

Bustamante recommended Delco Storm and Sewer Services for this work. Delco, located in Lansdowne, is a small company providing plumbing, sewer jetting, drain cleaning, trenchless pipe repairs and CCTV inspections. The business opened in October 2019 and was founded by John Ettore and David Hochberg. Ettore served as the lead of the two-man RAP inspection crew.

## Equipment and Cost

The inspection was performed using a Trio-Vision system consisting of a pan-tilt-zoom camera with LED lights mounted on a steerable crawler, a powered cable reel with 1,500 feet of fiber optic/power cable and a laptop style control unit. The system is battery powered, with two fully charged batteries providing enough energy for a full day of inspection work. The reported cost of the entire system is more than \$70,000. The color image resolution was remarkably detailed, with the ability to survey the entire 360° inside diameter of the pipe. In addition to the video and still images, the system software stores the date, time of day, pipe designation, distance of traverse in the pipe and any comments entered by the operator.



The camera system, two-person crew and support van costs **\$1,200** for up to 4 hours and **\$2,400** for more than 4 hours (full day rate). Had water jetting been required to clear built-up debris the rate was \$900 for up to 4 hours and \$1,800 for a full day. Delco noted that most of our Phase I system was very clean and required no jetting for inspection purposes.

## Inspection Process and Observations

The crew started at the top of Sloan Road where our stormwater system splits into east and west networks. They removed the first inlet grate, lowered the crawler into the structure, confirmed good control and video signals, installed a roller guide assembly for the cable, lifted the front wheels of the crawler into the reinforced concrete pipe (RCP) and then steered it down the line. The operator observed the image on the control unit screen and paused the crawler whenever an anomaly or defect was detected in the RCP. Notes were added, the distance recorded and then the crawler continued moving until it reached the next downstream inlet box. The crawler was then backed all



Roller assembly guiding cable



Camera/crawler in position on Sloan Road

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the way out of that section of pipe and retrieved to ground level (in some cases the crawler continued through the next inlet structure until it reached the third structure and then was backed out). The grate was moved back onto the basin's frame, the distance to any observed damage was determined with a calibrated measuring wheel and white spray paint was applied to the pavement at that location. The crew then moved down the road to the next inlet and repeated the process.

On the first day of the inspection, March 7<sup>th</sup>, Delco completed all of the Sloan Road system and found several areas of concern that will be detailed in their report. Prior to the inspection, pavement subsidence in the gutter in front of 191 Sloan Road was assumed to be associated with problems with the storm water system piping; however, that proved not to be the case as that section of pipe showed no evidence of damage.

The Delco crew returned on April 11 to complete the inspection of Thayer Way, the clubhouse parking lot and Fairmount Boulevard; they found these areas to be free of damage. They also attempted to access the StormTech infiltration chambers between the gazebo walkway and 198 Sloan Road through the street inlet but were not able to navigate the crawler past the corrugated outlet tee.

Also on April 11 a Pristine Green crew excavated turf areas near the front of 191 Sloan Road and found a void that reached underneath the curb and continued under a portion of the roadway pavement. Delco poured fluorescent dye into the void and then observed water flow in the next downstream inlet box, but no dye was apparent (confirming that the stormwater piping was intact in that area). Pristine Green then filled the void with stone, a cement/water mixture and compacted it as best they could. No explanation for the void and other subsidence in that area was found.

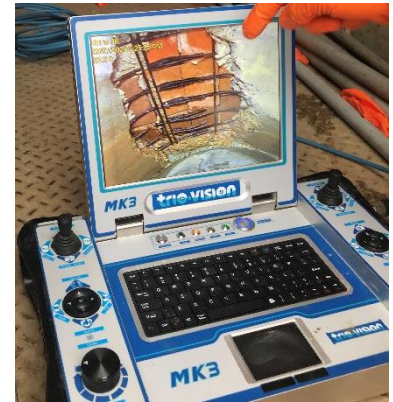
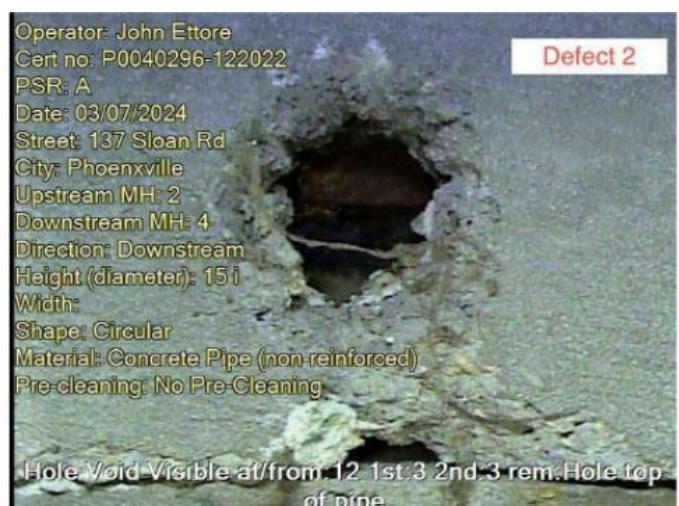


Image of pipe damage under Sloan Road

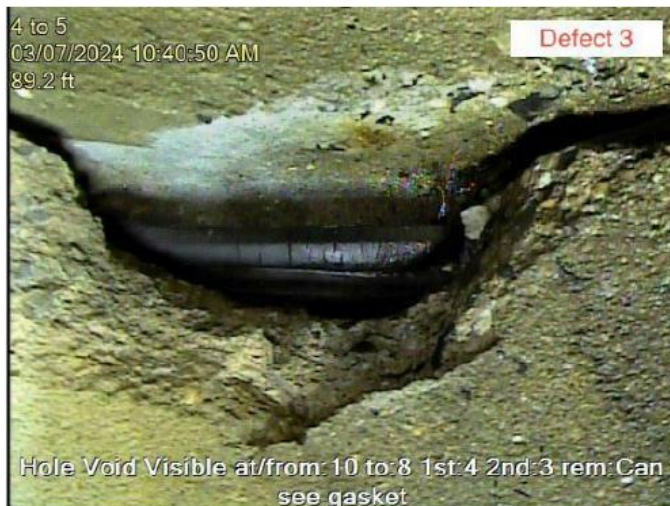
Delco noted that areas of pavement subsidence around a number of the inlet structures was likely caused by inadequate compaction of the surrounding fill material during construction of the system. Groundwater in-leakage at any improperly sealed horizontal structure joints, or a failure of the seal, could also be contributing factors.

### Inspection Report and Recommended Repairs

A preliminary report from Delco indicated that four areas of the Sloan Road stormwater system were recommended for repair. The following are screen shots from the inspection video depicting the nature of the internal pipe damage at each of the locations. The first three are located in 15" diameter pipe under the western portion of Sloan while the fourth defect is in 24" diameter RCP under the eastern portion of Sloan.







Delco recommend that each area of damage be repaired with an internal four foot long resin-impregnated fiberglass/felt sleeve. This form of “trenchless” repair eliminates the need for excavating the damaged pipe and reduces both time and expense. When properly installed the expected life of such sleeves is 50 years. Delco’s quoted price for the work was \$5,120 per defect for a total of **\$20,480**. If done separately on different dates the cost of each repair would be \$6,945.

### Repair Contractor

Bustamante reached out to other vendors for comparative pricing and received a quotation from Trinity Subsurface, LLC of Wilmington, Delaware. Trinity is a five year old organization with a staff of 65 and annual revenue exceeding \$20 million. They perform buried utility mapping, CCTV inspections, hydro jetting, basin cleaning and trenchless pipe repairs. Trinity’s quote for each repair of the three 15” diameter pipes was \$3,500 and the repair of the 24” diameter pipe was \$4,000 for a total cost of **\$14,500**, a nearly \$6,000 savings. The RAP HOA Board approved this bid and signed a contract with Trinity for the repairs.

### Trenchless Repairs

Trinity began work on the 24” line on the east side of Sloan Road on May 20<sup>th</sup>. The following steps were involved:

- Clean pipe interior with 2,000 psi water jet (spent wash water extracted into vacuum truck)
- Confirm exact location of each damaged area with camera/crawler inspection
- Wrap inflatable rubber bladder (the “packer”) with plastic to preclude contact with excess resin
- Cut fiberglass/felt sleeve material to size
- Weigh and mix A and B components of liquid silicate resin
- Trowel resin onto both sides of repair sleeve
- Wrap 4 foot long sleeve around packer and secure with zip ties
- Insert packer into upstream inlet structure and (from next downstream inlet) pull into position
- Inflate bladder with 30 psi air, packing repair sleeve against pipe inside diameter
- Continue pressurization with small, portable compressor lowered into inlet structure
- After at least 4 hours of cure time, depressurize packer and remove from pipeline
- Confirm proper repair by camera inspection, replace inlet grates and clear worksite of material/tools

The following photos provide a visual summary of the pipe repair process.





The hydro-vac truck pumps high pressure water, uses a vacuum system to extract it and has tanks to store both the clean and spent water.



Connecting sections of vacuum line prior to jet cleaning the damaged RCP section. Note the reel of high pressure hose.



The high pressure cleaning head has rear-facing nozzles that propel the hose forward as the pipe interior is cleaned.



The cleaning hose progresses up the pipe (to the left) while the vacuum system extracts spent wash water.



Once the section of line is cleaned a camera-crawler is used to confirm the exact location of the defect.



The inflatable rubber packer is prepared for deployment into the stormwater line.





The packer is roped at both ends and wrapped in plastic to prevent the resin from contacting the rubber bladder. Note the red air hose used to pressurize the packer.



After weighing and mixing the two resin components it is poured onto the sleeve material....



....and then thoroughly spread over both sides of the repair sleeve.



The resin-impregnated sleeve is then wrapped around the packer and secured with plastic zip ties.



One crew member lowers the packer into the inlet structure, a second guides it into the pipe and the third pulls it into position from the downstream inlet.



Once in position, the packer is inflated to 30 psi, pressing the sleeve onto the pipe interior wall. A portable compressor (shown) is connected to maintain pressure while the resin cures.



Following removal of the packer at each location a final CCTV inspection revealed that the three defects under the western section of Sloan Road were properly repaired. However, the 4 foot long repair sleeve in the 24" diameter line under the eastern section of Sloan did not completely cover the damaged area (depicted as "Defect 4", on the third page of this report). This was likely caused by the repair sleeve slipping on the packer as it was dragged into position in the pipe. A second, overlapping repair sleeve was successfully installed, as confirmed by a final camera inspection, an image of which is shown below.



Beginning the week following the completion of this work the community's paving contractor, Delaware Valley Paving, undertook the milling and repaving of Phase I streets and the clubhouse parking lot. As part of this project Delaware Valley also replaced twelve damaged stormwater inlet caps.

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Ponds, Stormwater & Irrigation Committee  
June 2024