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2021 Project of the Year

NEW INSTALL • WINNER • 2021 • PROJECT OF THE YEAR

NEW INSTALLATION

Line 1021: Greys Point to Rappahannock Station-Rappahannock River Crossing

INSIDE COVER

Project of the Year for Rehabilitation
Liner Inversion Through Two 36-in. x 30-in. Reducers

River Valley Highlands Design-Build Sewer Rehabilitation

By Donald Rigby

River Valley Highlands (RVH) in Lancaster, Ohio, is a 10-year-old subdivision with a developer-constructed sewer system. Prior to development, surface runoff followed the natural topography, running into a bowl in the middle of the development followed by a swale to the west. The developer installed the RVH sewer system through the bowl, carrying the sewer to the City of Lancaster's interceptor, south of the site.

Ten to 15 basement backups occurred one to three times per year upstream of the topographic low. City officials would respond. The staff examining the sewers during and after storms reported extreme surcharging in manholes, but no clear sources of inflow and infiltration (I/I).

INVESTIGATION

Lancaster installed five flow meters which showed a significant baseline of groundwater infiltration and high rainfall derived inflow and infiltration (RDII). Flowmeter studies upstream and downstream of the backups showed high wet weather peaks (10 to 24 times) with sustained RDII flows. An investigation was performed, including smoke testing of 165 homes, roof drains and 29 basement inspections for sump-pump connections, none were found. A pilot project was conducted using manhole inspections, CCTV and air testing for mainline and lateral joints, which revealed that 17 percent of the joints and 41 percent of the lateral connections were leaking. A decision was made to test and seal all mainline and lateral joints in the RVH subdivision using the latest in grouting techniques.

ARCADIS advised the City's project engineers to consider every option to expedite including a design-build approach. It would be the first ever design-build project in the City's history.

DESIGN-BUILD APPROACH

Special legislation was passed to allow a design-build approach that provided Lancaster with specialty contractors, work control, guaranteed price and schedule, and a warranty on longevity and long-term RDII elimination. The work was implemented in five cost groupings:

- **Cost of Work:** The construction and oversight were open book subcontractor costs and base plus overhead cost for engineering with a guaranteed max price.
- **Cost of Project Management:** A single lump sum fee covered all admin and project management costs, including bonds, insurance, licenses and permits.
- **Fixed Profit:** A single lump sum fee covering all potential profit and risk.
- **Liquidated Damages:** An aggressive substantial completion date of 90 days from notice to proceed with $1,000 a day liquidated damages.
- **Contingency:** The City established a contingency allowance for this work.

IMPLEMENTATION

Arcadis developed technical specifications and work sequence plans to complete the 4.5 miles of sewer main, lateral and manhole rehabilitation in the priority area. To meet the aggressive substantial completion goal, Arcadis retained three contractors to complete the work: Lake County Sewer, Michels Corp. and Diversified Infrastructure.

DETAILS

- **2,582 lf –** Pre and post clean and CCTV 8- to 18-in. mainline sewer
- **4,652 Each –** Test and seal of 8-in. to

12-in. mainline joints.

- **57 Each –** Test and seal joints - laterals connected to manholes
- **489 Each –** Test and seal lateral taps with 8- to 20-ft sock
- **256 Each** – Test and seal lateral joints from cleanout
- **2 Each** – Longitudinal fracture defect grouting
- Warranty re-testing of mainline joints and laterals.

RESULTS

Completed in less than three months, the cost of the work was 83 percent of the guaranteed maximum price.

Failure rates were similar to predictions. Ninety-one segments totaling 22,582 lf of 8-in. to 12-in. vitrified clay pipe (VCP) were inspected and tested. Grouted 961 (21 percent) joints that failed the air test. Two hundred fifty-six (52 percent) lateral connections tests failed and were successfully sealed. Ninety-three percent of the laterals on 10-in. pipe and 70 percent of the laterals on 12-in. pipes, were found to leak.

Warranty testing conducted two years after completion of rehabilitation showed that 99.8 percent of the joints passed, 97.6 percent of the lateral tap connections passed and 100 percent of the pipes were structurally secure.

FLOW REDUCTION

In fall 2018, Ohio entered a period of heavy rainfall exceeding two times the average annual. No basement backups were reported. Additionally, during the May 28, 2019 storm that spawned more than 21 tornadoes across Ohio, peak flows did not exceed three times normal flow, and flows returned to normal within hours of the end of the storm event. In May 2019, Lancaster reinstalled meters within the RVH service area and flow data was collected from May 2019 until May 2020.

New Flow Data

- Forty-five percent of the RDII volume upstream of the Cross Creek meter was removed by this project. The City stall indicated that they believe there remains some significant inflow sources upstream of Cross Creek.
- Sixty-five percent of the RDII volume upstream of the Prairie Grass meter was removed by this project. When removing the RDII related to the upstream Cross Creek catchment, the RDII removed from the Prairie Grass catchment is 76 percent.
- Sixty-one percent of the RDII volume upstream of the Retention Pond meter was removed by this project. When removing the RDII related to the upstream Cross Creek catchment, the RDII removed from the Prairie Grass catchment is 69 percent.

Donald Rigby is in business development for Logiball and Prime Resins.