

Using a business case evaluation to justify an innovative sewer rehabilitation process

Flood Grouting for Infiltration Reduction on Private Side Sewers (INFR5R11)

The Central Issue

Many engineering studies have determined that for an infiltration reduction project to have optimal success, rehabilitation must address all sewer infrastructure components: the maintenance holes, mainlines, and side sewers up to the building connection. There are two poorly understood aspects of sewer rehabilitation – justifying the selected remedy and evaluating the economic and engineering performance based on the selected method. To address these poorly understood aspects, Seattle Public Utilities (SPU) conducted a pilot project to research new and innovative infiltration reduction methods, validate its business case evaluation (BCE) process, and assess the viability of working on private property. SPU found that the BCE could be used to justify the selected remedy.

Context and Background

The Broadview neighborhood in Seattle, Washington, has experienced frequent wet weather sanitary sewer backups into private property and sanitary sewer overflows into the public rights-of-way. Prior to this research, SPU conducted several studies that indicated that almost 80% of the peak flow during large storm events was due to infiltration. This WERF project detailed a process to justify an infiltration reduction sewer rehabilitation project under an intensive asset management-based evaluation process known as a business case evaluation. After complete documentation of the business case and the recommended approach, the cost effectiveness of an innovative sewer rehabilitation process on a large targeted area was documented. SPU selected the innovative Sanipor® flood grouting technology to rehabilitate the system. Flood grouting is the process of internally flooding an entire segment of sewer (manhole to manhole) and the side sewers all at once with a two-part chemical process that leaches to the surrounding soil through pipe defects to seal the pipe from infiltration.

Findings and Conclusions

The business case evaluation was conducted to identify a preferred alternative and to validate the rehabilitation project. The selection process identified four leading alternatives: flood grouting, joint grouting, pipe bursting, and cured-in-place pipe lining. The much higher cost and disruptive nature of open cut pipe replacement eliminated it from detailed analysis.



Flood grouting chemical is added to the system.

Cost estimates for each of the methods were developed and then compared to the benefits of completing the project. Some of the benefits include reduced claims, reduced storage costs at a regional wet weather treatment facility, reduced conveyance and treatment costs, installing cleanouts on side sewers, and inspecting privately held sewer assets. The business case process identified flood grouting as having the greatest benefit cost ratio of all the options and was selected as the preferred alternative.

The flood grouting was applied to a 31-acre residential sub-basin in the Broadview neighborhood. All of the maintenance holes and mainlines were sealed; however, only 30% of the total side sewer length, resulting in approximately 56% of the entire sewer basin was sealed. Based on measured exfiltration rates of the flood grouting chemicals, the sealed sections had a 99% improvement in their exfiltration rates. The average total construction cost per foot of sewer sealed was \$77 for this pilot project.

The business case benefits were recomputed following completion of the project. The total project costs came in 16% higher than estimated (\$1,478,000 versus \$1,275,000). Because the side sewers were not sealed to the extent as originally anticipated, the reduction of peak flows were not as high as expected, although the total volume reduced exceeded estimates. The total value of the benefits was concluded to be \$1,595,000 versus the estimated \$1,842,000. Despite this, the benefits still exceeded costs by a ratio of 1.08. The actual construction cost was \$1,033,400, resulting in a construction benefit cost ratio of 1.54. SPU intends to continue the use of this technology in select locations where sewer infiltration has been determined to contribute significantly to wet weather flow issues.

Management and Policy Implications

The research showed that conducting a business case analysis and evaluating the rehabilitation project after completion is worthwhile. Other benefits of conducting a post-project evaluation to be considered in the future were:

- The Sanipor® flood grouting technology is successful in reducing infiltration with relatively little disruption to the community and at a potentially lower cost than other technologies.
- Working on private side sewers is both necessary to attain maximum infiltration reduction and is achievable with effective public outreach.
- Use of flexible contracting options, such as use of a service contract, can improve project efficiency by reducing “soft costs”.

Executive Summary



Flood Grouting for Infiltration Reduction on Private Side Sewers



This figure depicts the simultaneous sealing of all existing leaks in the:

- sewer main
- full length of lateral pipes
- manholes

(Courtesy of Sanipor)

Related WERF Research

Project Title	Research Focus
SIMPLE: Sustainable Infrastructure Management Program Learning Environment (03CTS14)	This online knowledge enhances the ability to train personnel and provide guidance and tools to utilities of all types, sizes, and levels of practice in asset management. The purpose of SIMPLE is two-fold: to make asset management comprehensible and to promote information exchange among practitioners with various needs and experience levels. SIMPLE contains over 16,000 pages of best practices and guidance developed over a 20-year period and from extensive international experience and collaboration with AM practitioners. Includes tools for business case evaluation and PIP validation and prioritization among others.
Condition Assessment Strategies and Protocols for Water and Wastewater Utility Assets (03CTS20CO)	Provides information on how to effectively use condition assessment tools and techniques to improve both long-term planning and day-to-day management of assets. The report is structured for two distinct audiences: <ol style="list-style-type: none"> 1) Utility planning managers who want to use cost-effective condition and performance assessment programs to support long-term planning decisions. 2) Engineering/maintenance managers that want to identify and understand the advantages and disadvantages of tools and techniques for measuring the condition and performance of utility assets to support daily maintenance and operation of assets.
Leading Practices for Strategic Asset Management (SAM1R06h)	Identifies, documents, and validates leading practices through site visits and a research forum held in 2010. Leading practices are presented in an easy-to-follow format that cites and explains the practice and provides examples. The research is intended to assist utility managers in the practice areas of Organization and People, Strategic Asset Planning, Business Risk, Maintenance, Secondary Data and Knowledge, and Accounting and Costing.

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