



Project Summary

Selected Topics Related to Infiltration and Inflow in Sewer Systems

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The current state of the art in sewer system infiltration/inflow control was reviewed to gather information not included in earlier manuals and reports on this subject. A series of nine regional seminars was conducted to explore local problems and practices for solutions. The report includes an overview of information on problem determination as approached by the Washington Suburban Sanitary Commission, methods for flow determination (including a discussion of accuracy), economics of sewer rehabilitation, methods of rehabilitation, long-term rehabilitation programs, and long-term flow monitoring. Also included is a brief discussion of the major problems covered at the regional seminars.

This Project Summary was developed by EPA's Water Engineering Research Laboratory, Cincinnati, OH, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

With the passage of Public Law 92-500 in 1972, increased emphasis was placed on sewer rehabilitation for reducing the hydraulic loads on municipal sewage treatment plants during wet weather. Increased flow results from the leakage of groundwater into the sanitary sewer system through open joints, cracks, and holes. In addition, flow increases through above-ground discharges from building drains of various kinds, and stormwater

can enter manholes directly. The combination of these sources of infiltration and inflow can cause very significant increases in the total flow to a treatment plant.

In response to the increased importance of sewer rehabilitation and other control techniques to reduce infiltration and inflow (I/I), a number of manuals have been written on the subject by both the U.S. Environmental Protection Agency (EPA) and by other scientific and professional organizations.

This project was undertaken to review the state of the art for I/I control and to make additional information available to users. A series of nine regional seminars was conducted to determine the most significant I/I problems in various parts of the United States. Topics were formulated from a list of significant problems, and new information was sought on these topics. The results were combined to make the full report. The seminars also aided information exchange between EPA officials, representatives of state and local governments, and consultants.

Overview

The regional seminars highlighted the diversity of problems encountered by public agencies in various parts of the country. Because of existing physical conditions such as age of the system, local practices, and soil and groundwater conditions, national guidelines must be broad to allow for local needs. In addition, the regional seminars provided an extensive review of the EPA regulations governing I/I studies. The review determined many potential trouble spots for local agencies

in adhering to the national guidelines. Those who attended the seminars also identified two agencies that are conducting extensive local programs for I/I control—the Washington Suburban Sanitary Commission (WSSC) of the city of Hyattsville, Maryland, and the City of Salem, Oregon.

This report is based on comments made at the regional meetings. Chapters were developed to cover the major points discussed. The topics for each section are described here briefly.

Problem Determination by the Washington Suburban Sanitary Commission

The program of the WSSC is a very comprehensive attempt to overcome many of the identifiable failings of the standard sewer system evaluation survey program. Under the program, internal inspection is scheduled to allow final rehabilitation recommendations by autumn of 1985. The approach being followed is designated as the "systems approach to sewer system evaluation." The systems approach, in turn, is based on the concept that collection systems have "individual personalities." Since certain system personalities behave similarly, they can generally be compared and defined where pipe type, joint material, and other accepted grantee compliance requirements are similar. An accelerated pilot study of the systems approach to subarea rehabilitation has been approved by the local regulatory agency. The results of the study should be available at approximately the time the sewer system evaluation is completed.

Determining Excessive I/I and Precise Flow in Sewers

The full report includes an analytical listing of the various methods, including smoke testing, used to determine whether I/I should be considered excessive.

Difficulties are encountered in determining precise flow in leaking house laterals. Such difficulties are the result of the inaccessibility of the point of discharge from the house lateral to the street sewer. Care must be taken to minimize the error inherent in each item of measurement. The final report reviews interpretation of monitoring data and the potential range of error in discharge data. The report also reviews the range of error experienced in flow monitoring, together with an error analysis scheme for estimating energy slope. The error in the parameters for

various flow-estimating formulae is also covered.

Economics of Rehabilitation

The economics of rehabilitation are reviewed with the aim of helping the investigator to make decisions by discussing the problems associated with current rehabilitation practices. One of the easiest rehabilitation techniques available on the market is sealing and grouting. Associated problems arising from this technique are traffic control, mobilization, and cleaning. They are presented in detail in the full report. Similarly, other techniques are discussed with the view of what is needed to evaluate a rehabilitation project economically.

Techniques for Rehabilitating Sewer Mains

The full report evaluates six basic techniques involved in rehabilitating sewer mains. A decision tree outlining steps required for various methods of sewer rehabilitation is included. Techniques are examined briefly and the positive and negative aspects of each are discussed. Processes reviewed are classified as follows:

- (1) Spot repair
- (2) Reconstruction in place
- (3) Construction of a bypass
- (4) Grouting
- (5) Sliplining
- (6) Inversion lining

A flowchart presents guidelines for the use of each technique.

Inspection and Maintenance

The materials and workmanship used in the inspection and maintenance processes of sewer systems are listed in the full report. The inspection process discussed consists of two phases: cataloguing through inventory and inspection by television surveillance. Also discussed are the two phases that make up the maintenance process—the repair of deteriorated sections and cleaning of the lines to allow free flow.

Long-Term Flow Monitoring

The phases of long-term flow monitoring are separated into three sections: preparation of location, purchase and installation of equipment, and evaluation of the project before and after completion. A rehabilitation project must consider factors such as prior moisture conditions, flow versus rainfall, flow versus intensity,

flow versus duration, and existing conditions.

Comments of Participants

The full report summarizes comments of the participants at the various meetings held by the American Public Works Association for the project. Topics summarized are:

- House lateral construction problems
- House lateral contributions
- House lateral rehabilitation techniques
- Single point versus multi-point monitoring
- Illegal connections
- Cross connection
- Manhole inflow
- Groundwater migration
- Cost effective I/I removal
- New development standards
- Improved building lateral access

A key concept of this report is the need for local agencies to initiate continuing preventive maintenance programs. This step is necessary to maintain the minimum level of extraneous water flows. A sewer system cannot be rehabilitated on a one-time basis and never develop additional points of infiltration or inflow. Multiple factors may be responsible for various types of defects that allow I/I to enter the system.

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The complete report, entitled "Selected Topics Related to Infiltration and Inflow in Sewer Systems," (Order No. PB 85-177 202/AS; Cost: \$11.50, subject to change) will be available only from:

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