

Report for
City of Fond du Lac, Wisconsin

Private Property Inflow and Infiltration
Identification and Removal

Draft

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**SECTION 1
INTRODUCTION**

1.01 BACKGROUND

The purpose of this report is to provide information to evaluate current and emerging issues and technologies related to identification and removal of inflow and infiltration (I/I) from private property. A variety of sources were used in the development of this report. The sources included periodical articles, publications, conference proceedings and presentations, consultant reports, textbooks, and surveys. Information from these sources is summarized in this report. Readers should reference the primary sources if more information is necessary. One copy of the following publications is being provided along with this report because they were extremely useful in the preparation of this report:

- *Control of Infiltration and Inflow in Private Building Sewer Connections*, published by the Water Environment Federation (WEF), is a useful monograph that gives a general overview of the challenges associated with implementing a program to reduce I/I from private property. The information presented in this document is based on the results from a questionnaire that was sent to sewer agencies across the country.
- *Methods for Cost-Effective Rehabilitation of Private Lateral Sewers* published by the Water Environment Research Federation (WERF) is an extensive work based on a survey of 58 agencies that details the experiences, issues, and results of efforts by these communities. It also gives specific information about location, inspection, and repair methods for sewer laterals.
- An article included in the July 2005 issue of WE&T titled, *It Can Be Done—Some legal issues to consider when managing infiltration and inflow from laterals*, provides useful information about the legal issues associated with repairing privately owned sewer laterals. The article is based on Wisconsin law.

1.02 INTRODUCTION

Infiltration is groundwater that seeps into the collection system through defects such as cracks and broken joints. Inflow enters the collection system through direct connections such as foundation drains and roof leaders. I/I can occur throughout the entire collection system and, if left uncontrolled, can be a major contributor of flow to the sanitary sewer collection system. Increasing enforcement of environmental regulations relating to sanitary sewer overflows (SSOs) and combined sewer overflows (CSOs) is forcing municipalities to implement programs to reduce and/or eliminate overflows from the collection system. I/I reduction is one method to reduce SSOs and CSOs. Section 2 of this report contains a more in-depth description of private property I/I and the potential sources.

Successful I/I reduction programs incorporate three essential steps:

- First, they identify and quantify the sources of I/I within their system. Numerous technologies exist for inspection and analysis of collection systems. The specific inspection program is selected depending on the condition of the existing system, the I/I sources being considered, and the municipality's needs.

- Second, they select an appropriate repair or rehabilitation program. Successful programs use a variety of methods to complete efficient and effective repairs.
- Lastly, and most importantly, the municipality continues to maintain and improve the collection system including sewer laterals.

This report includes a discussion of these steps and the alternative approaches for each of them in Sections 2 and 3.

When municipalities choose to implement an I/I reduction program, both public and private portions of the collection system should be considered for inclusion. Controlling private I/I is inherently difficult because the municipality does not own the private portion of the system, which brings up numerous legal considerations including funding, property access, and liability. These and other legal considerations are discussed in Section 4.

The success of private I/I programs across the country has been greatly influenced by the financing alternatives selected for the program. Alternatives range from programs that are completely financed by homeowners to insurance programs to programs that are completely financed by municipalities. Municipalities that have clearly defined programs with specified deadlines and consequences seem to be the most successful. Section 5 discusses financing alternatives.

1.03 ABBREVIATIONS AND ACRONYMS

CCTV	Closed Circuit Television
CSO	Combined Sewer Overflow
GPR	Ground Penetrating Radar
I/I	Infiltration and Inflow
SSO	Sanitary Sewer Overflow
TV	Television
WEF	Water Environment Federation
WERF	Water Environment Research Federation

1.04 REFERENCES

Water Environment Federation, *Private Property I/I Control.....The Rest of I/I Story*. Proceedings Preconference Workshop at WEF Collection Systems 2004: Innovative Approaches to Collection Systems Management, Milwaukee, Wisconsin, August 2004.

Simpson, Michael H., *It Can Be Done—Some legal issues to consider when managing infiltration and inflow from laterals*, WE&T, July 2005, pp. 26-31.

Gonwa, Willie, Ph.D., P.E., TEI, *Milwaukee MSD's Private Property I/I Reduction Program*, Proceedings Indiana Water Environment Association 69th Annual Conference, November 2005.

Simicevic, Jadranka, and Raymond Sterling, *Cost Effective Rehabilitation of Private Sewer Laterals*, Proceedings Collection Systems 2006, Water Environment Federation, Detroit 2006.

Water Environment Federation, *Control of Infiltration and Inflow in Private Building Sewer Connections*, Alexandria, Virginia, 1999.

Water Environment Federation, Private Lateral Program Questionnaire, 2006.

Sterling, Raymond L., et. al., *Methods for Cost-Effective Rehabilitation of Private Lateral Sewers*, Water Environment Research Federation, Alexandria, Virginia, 2006.

Strand Associates, Inc., *Inflow and Infiltration From Private Property Sanitation District No. 1 of Northern Kentucky*, Cincinnati, October 2006.

Metcalf & Eddy, Inc., *Wastewater Engineering Treatment and Reuse*, Boston, 2003.

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**SECTION 2
INTRODUCTION TO INFILTRATION AND INFLOW**

2.01 SOURCES OF INFLOW AND INFILTRATION

I/I originates from many locations on private property including roof drains, driveway or other area drains, sump pumps, foundation drains, and cracks in the sewer lateral. Figure 2.01-1 shows the potential sources of private I/I and how they connect to the public system. Inflow sources account for large portions of I/I and can be easier to repair than infiltration sources because they are direct connections to the piping system where infiltration sources are often leaks or cracks in the pipe. Some inflow sources can be eliminated with simple repairs like replacing cleanout caps and disconnecting downspouts. Removing infiltration often requires repairs of entire piping systems or sections of systems.

2.02 PRIVATE VS. PUBLIC I/I

When a municipality begins an I/I evaluation, a distinction between public I/I and private I/I needs to be made. This distinction is made using local ordinances and practices. Based on the surveys and questionnaires used as primary sources for this project, municipalities delineate between the private and public system in a few different ways. These definitions are summarized in Table 2.02-1.

The most common definitions for the private lateral contained in the WERF report are from the house to the mainline including the tap (40 percent of agencies) and from the house to the property line (43 percent of agencies). Other definitions included from the house to the mainline excluding the tap (16 percent of agencies) and one system had inconsistent definitions within their system (1 percent of agencies).

Definition of Private Lateral	Number of Municipalities
House to mainline (including tap)	40%
House to property line	43%
House to mainline (excluding tap)	16%

Table 2.02-1 Definition of Private Lateral (Adapted from WERF)

Infiltration

Water entering a collection system from a variety of entry points including service connections and from the ground through such means as defective pipes, pipe joints, connections, or access port (manhole) walls.

Steady Inflow

Water discharged from cellar and foundation drains, cooling water discharges, and drains from springs and swampy areas. This type of inflow is steady and is identified and measured along with infiltration.

Direct Inflow

Those types of inflow that have a direct stormwater runoff connection to the sanitary collection system and cause an almost immediate increase in wastewater flow rates. Possible sources are roof leaders, yard and areaway drains, access port covers, cross connections from storm drains and catch basins, and combined systems.

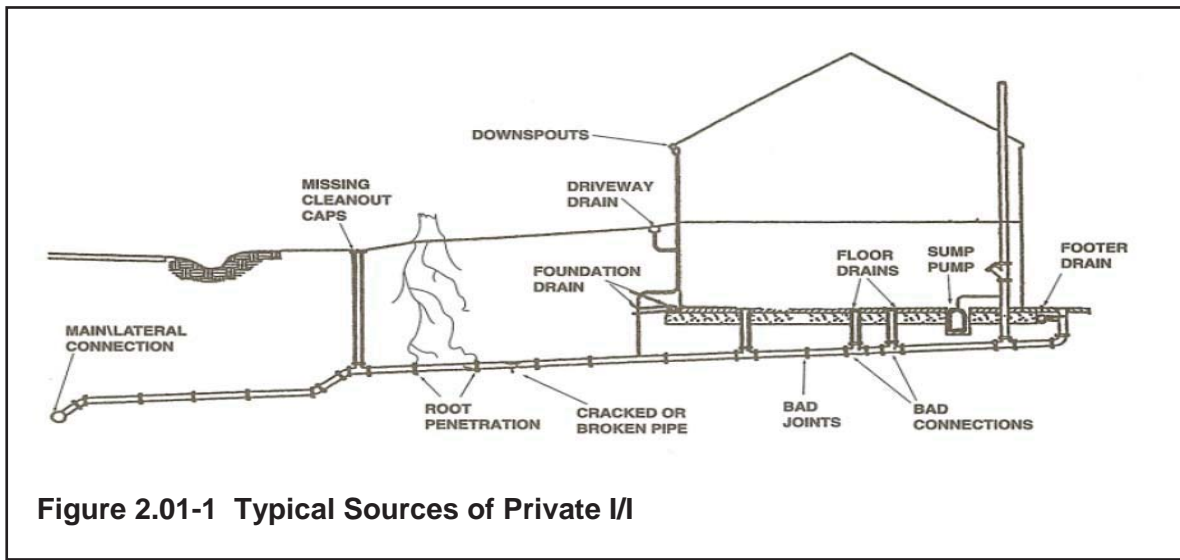
Delayed Inflow

Stormwater that may require several days or more to drain through the collection system. Delayed inflow can include the discharge of sump pumps from cellar drainage as well as the slowed entry of surface water through access ports in ponded areas.

Metcalf & Eddy, Inc., p. 163

Results of the *Private Lateral Program Questionnaire* included the following responses. The frequency of each response is listed in parenthesis:

- From the building to the tap on the sewer main line. (5)
- From the building to the right-of-way or easement line. (2)
- From the building or landscaped area to the sewer main line. (1)
- From the building to the property line. (2)
- From the building to the sewer main line including the tap on the main. (1)
- From the building cleanout to the agency cleanout at the property line or to the sewer main line if no cleanout present. (1)



From these two sources, the most common definition for the private lateral is the section of pipe extending from the building to the tap on the sewer line. The tap may or may not be included.

Some municipalities have chosen to break the sewer lateral into upper and lower portions so that repair and inspections can be handled differently for each portion of the lateral. The upper lateral is the portion of the lateral between the property line and the home. The lower lateral is the portion of the lateral between the property line and the tap at the mainline.

2.03 LOCATION OF CLEANOUTS ON PRIVATE LATERALS

Many municipalities require installation of cleanouts on private laterals. Cleanouts are typically installed in private laterals at periodic intervals, e.g. every 50 feet, or changes in direction and at the property line. They are used to clean pipes or for pipe access. They are also useful locations to insert monitoring devices or plugs into laterals for location, inspection, or repair. Cleanouts have been required by municipalities at the house, at the property line or edge of right-of-way and/or at the tap to the mainline. Cleanouts in one or more of these locations are useful for inspections and for defining boundaries between the private and public domain.

Some municipalities require lateral cleanouts on new construction but do not require older construction to retrofit with cleanouts in the plumbing code. Requiring cleanouts at the property line, house, right-of-way, or mainline should make lateral location, inspection, and repair easier in the future. As well as requiring cleanouts in new connections, cleanouts should be added during repair or inspection projects if laterals are accessed. The location of cleanouts and whether or not they are required is a key issue in the overall private sewer lateral conversation and was a featured question in WEF's *Private Lateral Program Questionnaire*. Cleanouts were required at the building by 70 percent of the utilities. Cleanouts were required at the right-of-way by roughly one-third of the utilities, and cleanouts were required at the easement by 15 percent of the utilities. Just under a quarter of the utilities required multiple cleanouts.

2.04 LOCATING PRIVATE SEWER LATERALS

Technologies used to locate sewer lines include technologies like closed circuit television (CCTV) inspections of the mainline or lateral, walk-over sonde detectors, and ground penetrating radar (GPR). All of these technologies have been used to locate private sewer lines with varying degrees of accuracy and repeatability. Smoke and dye testing are two other methods that are commonly used in sewer lines and laterals. Smoke is good for testing condition of laterals (under certain circumstances) but is not good for “locating” laterals. Dye is good for verifying where laterals enter public sewer but not for locating the actual lateral.

Private sewer laterals can be located through more indirect means as well. These are occasions where the primary goal of the project is not sewer lateral location, but sewer laterals happen to be located in the process. The WERF report, *Control of Infiltration and Inflow in Private Building Sewer Connections*, listed the following indirect means of locating private sewer laterals, which were results of their survey:

- When mainlines are inspected or repaired, the lateral-to-mainline connections are also recorded.
- When mainlines are relocated, all connecting laterals must also be located and rerouted.
- Prior to any excavating, the agency may choose to locate all existing laterals in the area following the utility location request from contractors, in advance of construction.
- Sale of property may require the locating of laterals. Please note that this is controversial and not practical in all communities (WERF, 2-11).

Section 3 of the WERF report has a very detailed explanation of the alternative lateral location processes.

Whether using direct or indirect methods of locating private sewer laterals, it is critical to establish an accurate and accessible means of information storage, such as GIS, so that the information is not lost and can be used by others in the future.

2.05 QUANTIFICATION OF PRIVATE I/I

Methods of quantifying the amount of I/I in a collection system varies from municipality to municipality as does the definition of I/I, which makes it difficult to compare I/I quantities and reductions from one municipality to another. The difficulty in quantifying I/I consistently is that methods to specify base flow and I/I differs from one system to the next. Additionally, it is difficult to measure results after improvements have been made because quantification of I/I relies on storm flow, which is an uncontrolled variable. Results vary greatly between programs as was discovered in the research performed by Strand Associates for its report, *Inflow and Infiltration from Private Property*, for Sanitation District No. 1 (SD1) of Northern Kentucky.

The research performed by Strand Associates for the SD1 report indicated that despite the significant amount of time and money spent on implementing private source removal programs, there was limited monitored data available regarding benefits achieved. Table 2.05-1 is a summary of measured I/I reductions achieved by five different municipalities with private source removal programs that were included in the research.

“A study for the EPA, in 1981, noted that many sewer rehabilitation programs eliminated approximately 0 to 30 percent of I/I, despite engineer predictions of 60 to 90 percent I/I removal.” As mentioned above, most cities do not have actual monitored data that shows the reduction in I/I after rehabilitation of the system. The following examples show the type of data collected or situations observed by several communities around the nation.

Community	Percentage of I/I Reduction
Prichard, Alabama	33%
Johnson County, Kansas	41.7% - 71.1%
Oak Creek, Wisconsin—5-year Rainfall Dependent I/I	48%
Duluth, Minnesota— 5-year Rainfall Dependent I/I	49%
Salem, Oregon— 5-year Rainfall Dependent I/I	57%
East Bay, California	86%

Table 2.05-1 Measured I/I Reduction

Other communities have seen a positive change in their system because of I/I removal programs. As of December 1996, with part of the private program complete, four subbasins in Lower Paxton, Pennsylvania, showed significant flow reductions (1996 had the most recorded rainfall for Pennsylvania in ten years). Lynchburg, Virginia, found that eliminating 75 percent of roof leaders eliminated 20 percent of the system overflows. As of July 2002, 725 homeowners in Duluth, Minnesota, had participated in the voluntary disconnection/redirection of foundation drains, which reduced the number of SSOs at the pump station from an average of 7.4 to 1.2 per year, an 83 percent reduction. In Rockford, Illinois, postrehabilitation flow monitoring was done in 2000. Analysis showed that the public/private sector program reduced wet weather inflow in excess of 65 percent (public inflow sources accounted for 25 percent of total system inflow).

Section 4 of the WERF report contains an in-depth discussion of various methods and examples of quantifying I/I and reduction of I/I because of system improvements in collection systems and specifically in private sewer connections. The reader should refer to this report for case studies of other utilities’ methods of quantification. The section begins with a discussion of the various types

of I/I and how different municipalities define I/I. The chapter then goes through a discussion of quantifying overall I/I in collection systems, including methods of developing hydrographs, and of quantifying I/I specifically from laterals. The lateral portion contains a number of quantitative and qualitative methods of gathering information from laterals. Lastly, the effectiveness of lateral rehabilitation in I/I reduction is evaluated. From this chapter, it is clear that quantifying I/I and I/I reduction is a challenging task and there is no clear-cut alternative to get reliable results; however, quantification is an essential element of any I/I project.

Quantification of I/I reduction can become important when a municipality needs to evaluate the effectiveness of an I/I program. Being able to defend the purpose of expenditures with real results is an effective method of generating support. The overarching theme when comparing I/I from one location to another is that definition, measurement means, and analysis vary greatly and can lead to misunderstood results.

2.06 INSPECTING PRIVATE SEWER LATERALS

There are a variety of methods available for lateral inspections that range from straightforward and simplistic to technically complicated. Table 2.06-1, taken from the WERF report, is a summary and description of the available methods.

CCTV inspection of laterals and electro scanning are some of the newer technologies. There are two types of camera systems used for lateral inspections. The first is a push-type system that is inserted into the system at a cleanout outside of the house or in the basement and manually pushed through the lateral line. The typical push-type system has a cable length between 100 and 200 feet but can be extended up to 500 feet. The other type of camera system is a lateral camera that is “launched” into the lateral from a mainline camera and can

Method	Description	Notes
Building inspections	Identifies uncapped cleanouts and various connections to the laterals through visual inspection.	Often coordinated with property transfers.
Smoke testing	Identifies various connections and defective service laterals.	3600 ft per day at \$0.15 to \$0.61 per ft
Dye water flooding	Identifies defective laterals, through exfiltration testing, and various connections to the sewer lateral.	
Mainline CCTV	Identifies “suspect” laterals and may be able to inspect first few feet of the lateral.	Could be used to eliminate laterals that are in good condition from inspection
Lateral CCTV	Identifies location and size of active leaks and some nonflowing leaks (water stains). Also identifies change in pipe material/diameter along the lateral, sags, and bends.	20 to 30 laterals per day at \$200 to \$400 per lateral
Pressure testing	Identifies existence of both actively flowing and nonflowing leaks.	\$75 per lateral
Electro scanning	Identifies existence of both actively flowing and nonflowing leaks in nonconductive pipes.	10 to 15 laterals per day at \$200 per lateral

Table 2.06-1 Methods for Inspection of Sewer Laterals (Adapted from WERF, Table 3-30)

usually inspect up to 100 feet of the lateral. Most systems can handle slight elevation changes and pipe bends; however, main line lateral cameras have limits to the extent of a bend. It is recommended that pipes should be cleaned before using a lateral CCTV; keep in mind, this is a cumbersome and time consuming process and may not always be practical. Data from these analyses can be automatically recorded and reported with specialized software like Felxidata by PipeLogix Inc. Electro scanning using the Focused Electrode Leak Location (FELL) technique measures the electrical current flow between a probe in the pipe and a surface electrode. The current spikes when the probe passes defects in the lateral because of the increased conductivity at these locations. This technique is only applicable for nonconductive piping systems.

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**SECTION 3
REPAIR IMPLEMENTATION**

Once faulty private laterals are identified and selected for repair, municipalities must organize a plan to hire and pay contractors or coordinate the work internally. There are a few alternative approaches discussed in this section.

3.01 REPAIR SERVICES

There are questions that arise when beginning a lateral repair program:

- Who will perform lateral repairs?
- How will they be hired?
- How will they be paid?

Municipalities have used internal staff, preselected contractors, or user-selected contractors to repair laterals. When the workload has a short duration and a high intensity, oftentimes it is more cost-effective for municipalities to hire outside contractors (whether preselected or not). If the municipality desires to create a long-term program that methodically works through the system, the addition of internal staff may be more cost-effective. When individual users are required to select their own contractor, the municipality is forced into a precarious position. On one hand, the municipality is typically well-qualified and could assist users in selecting qualified contractors. On the other hand, some users want the freedom to use the contractor of their liking, particularly when they are paying for the services. Johnson County Wastewater (Kansas) has achieved this balance by providing users with a list of contractors that are qualified but does not require users to use these contractors (WEF. Private).

Contractor hiring can be performed by the municipality or by the user. Contractors can prepare their quotations as a price reflecting the specific scope of work, or the municipality can set up a schedule of values that identifies a specific dollar amount for each type of repair. Some municipalities require that contracts be reviewed by them prior to beginning the work. This is common for municipalities that reimburse homeowners for the repair.

Payment methods differ greatly between municipalities who fund a portion of repair costs. They range from municipalities contracting directly with contractors to users paying the contractors directly and being reimbursed by the municipality. The payment methods should be tailored to fit with the program selected by the municipality.

3.02 REPAIR METHODS

Repair methods for sewer laterals are similar to those for sewer mains as discussed in the Strand report, *Sanitary Sewer and Manhole Rehabilitation*. Section 4 discusses the following lateral repair methods:

- Replacement
- Lining
- Grouting
- Coating

Removal methods for both inflow and infiltration sources are discussed in this report section. Additionally, Section 5 of the WERF report discusses lateral rehabilitation and repair methods. These two sources provide ample information about technologies, applications, and vendors.

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Municipalities must consider the legal implications of implementing a private property I/I control program. While an engineering report cannot provide legal opinions, a review of the literature reveals some of the issues that other municipalities have encountered.¹

4.01 LEGAL PERSPECTIVE

The process of inspecting and repairing private property sewer laterals brings up many legal issues concerning financing, access, and liability. Homeowners often do not understand the delineation between the publicly owned and privately owned portions of the sewer system. Additionally, it is difficult for homeowners to understand the potential impacts of defective laterals on the public sewer system.

In an effort to avoid disputes with private property owners over ownership and financial responsibility for the private sewer lateral, ordinances should be carefully written. These documents should include a clear delineation between the public and private systems including a description of the homeowner's responsibilities as they relate to the private lateral line. Municipalities must take care to create a solid legal foundation through well-written ordinances and clear correspondence with customers for a program to be successful.

Two recent publications provide valuable information on Wisconsin legislation and case law and how it pertains to managing I/I from sewer laterals. (Michael H. Simpson of Reinhart Boerner Van Dueren S.C. made a presentation titled *Legal Issues Involved in Implementing a Private Property Infiltration and Inflow Control Program* at a Preconference Workshop for the Water Environment Federation's Collection Systems 2004 and published *It Can Be Done* in the July 2005 edition of *Water Environment & Technology*.) Much of the information contained in these documents is summarized in this section along with information from other sources.

4.02 LEGAL CONCERNS

1. Financing

Many states outlaw spending public monies for private gain through their public purpose doctrines. While spending public monies on private sewer laterals may be interpreted as private gain, precedents outside the utilities sector suggest that courts could uphold this practice as legal because improvements to private sewer laterals contribute to the overall public good by reducing SSOs or CSOs and improving public health. For example, the Wisconsin Supreme Court allowed public monies to be given to the Marquette School of Medicine to avoid a doctor shortage in the state because the funding was intended for the public good in their ruling in *State ex rel. Warren v. Reuter*. Considering this decision combined with the fact that the court stated that "it is beyond question that sewerage services promote the public health and well being" in their ruling in *Brookfield v. Milwaukee Metropolitan Sewerage District*, it appears that the Wisconsin courts may support spending public monies on private sewerage systems. However, the Wisconsin courts

¹ Before implementing any I/I control program, municipalities are advised to consult their attorneys regarding specific legal advice on the issues discussed in this section.

have not had a ruling to date specifically addressing funding for private property I/I reduction programs.

Despite this absence of case law, some cities in Wisconsin use public monies for private property I/I reduction programs. For example, Mequon, Wisconsin, has a lateral replacement program that covers the first \$1,000 of the costs associated with lateral replacement. Costs over \$1,000 or relating to nonlateral replacement items including landscaping are covered by the homeowner. At this time, examples of this in Wisconsin are limited because of the small number of communities addressing private property I/I. Cities throughout the United States have used a variety of financing strategies, which are discussed in detail in Section 5.

2. Inspection

Gaining access to private property for inspection is another hurdle that must be crossed. Often, owners are willing to grant municipal employees access if the need for the inspection is explained. However, some homeowners may refuse access. In Washington County, Oregon, gaining access to private property was a primary hindrance in developing their comprehensive service connection rehabilitation program. When the authority changed from a 50 percent cost-sharing program to a 100 percent funded program, the participation rate jumped to 95 percent (WEF, 14).

The Fourth Amendment of the United States Constitution is the primary legislation that protects private property owners' search and seizure rights. Inspections must be conducted within the limitations set forth in the Fourth Amendment.

Camara v. Municipal Court is the leading case that defines a municipality's rights to inspect private property. In this case, the court upheld the requirement for a warrant prior to a property search, but it allows searches based on passage of time, nature of building, or the condition of the entire area; that is, evidence of specific code violation is not required. Examples of appropriate reasons for a search under each provision are included below.

The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no Warrants shall issue, but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.

—Fourth Amendment, United States Constitution

- Passage of Time—Properties can be searched at a set frequency. For example, a municipality can require that properties be inspected every five years.
- Nature of Building—Municipalities can require inspections of all structures with certain features, i.e., sewer laterals in the back of the house or homes of a specified age.
- Condition of the Entire Area—Municipalities can require inspections of areas with higher I/I than surrounding areas, i.e., all homes contributing to a specified sewer main.

Specific laws governing access to private property vary greatly from state to state. In Wisconsin, access can be granted by warrant if initial inspection is refused based on Wisconsin Statute 66, which reads:

A peace officer may obtain a special inspection warrant for inspection of private properties only upon showing that consent to entry for inspection purposes was refused.

—Wisconsin Statute §66.0119(2)

Although obtaining warrants for access is not the preferred entry method, the ability to enter with a warrant ensures that all properties can be included in private property I/I reduction programs in Wisconsin.

3. Liability

The added responsibility of inspecting, repairing, and maintaining private sewer laterals is seen as burdensome by some municipalities. Because sewer laterals may represent as much as 50 percent (by lineal feet) of a city's entire collection system, there is a significant increase in workload when private laterals are added to the municipality's responsibilities. However, some municipalities see worthwhile benefits through reduced plant flow, reduced basement backups, and improvements to public health when private laterals are maintained by the municipality. Some municipalities take on sewer laterals in a stewardship role because they recognize the problem needs to be addressed and they are best suited to facilitate a program. These are a few of the reasons there is such a broad range of programs.

If a municipality decides to take on the responsibility of inspecting, modifying, or maintaining private sewer laterals using its staff or contractors, the municipality may be increasing its liability. A few examples contributing to increased liability follow:

- Presence of municipal staff on private property when normally they would not be there.
- The possibility of workmanship-related problems in the future.
- The potential for the municipality's equipment to cause damages to the property.
- The possibility that lack of continued maintenance on modified laterals will lead to future problems, meaning that once the municipality begins lateral maintenance, they may be responsible for it going into the future.

Municipalities need to carefully consider the potential increase in liability when planning a private sewer lateral program and may want to evaluate the need to adjust applicable insurance policies.

Municipalities may be liable for negligent acts by their employees on private property. Examples of negligence include improperly completing a repair or omitting a critical work element. In Wisconsin, municipalities are liable for negligent acts if the act is ministerial. If the act is discretionary, the municipality is not liable for negligence. Acts are categorized as ministerial

...when [the act or duty] is absolute, certain, and imperative, involving merely the performance of a specific task when the law imposes, prescribes, and defines the time, mode, and occasion for its performance with such certainty that nothing remains for judgment or discretion...

—*Lister v. Board of Regents*

In its 2000 ruling in *Willow Creek Ranch LLC v. Town of Shelby*, the court conceded that it is difficult to eliminate every ounce of judgment or discretion from an act and the distinction between discretionary and ministerial is artificial. However, case law supports the distinction that plans and designs for collection systems are discretionary acts (*Allstate Ins. Co. v. Metropolitan Sewerage Commission*) and operations and maintenance of sewer systems are ministerial acts (*Mennick v. City of Menasha*).

Griffin v. Poetzi is a case that specifically relates to a municipality's liability when a negligent code-compliance inspection by an independent contractor results in damages. In this case, the Wisconsin Court of Appeals ruled that a municipality was not liable for related damages when an independent contractor was hired to perform code-compliance inspections. If the contractor was truly independent, the contractor was liable for damages. However, contractors who are provided with precise specifications, review the specifications, and warn the municipalities of any shortcomings of the specifications that they are aware of are entitled to the same immunity as the municipality.

Some recommendations from Simpson's article *It Can Be Done* for municipalities to minimize their liability when hiring independent contractors to perform inspections and investigations include:

- Requiring contractors to carry insurance to cover potential related claims.
- Writing contracts to protect the municipality from damages caused by contractors.
- Obtaining insurance to cover potential damages in case a court rules the inspectors did not qualify as independent contractors.
- Making sure property owners agree to waive claims against the municipality and instead pursue the contractor for compensation from negligence-related damages.

4. Summary

Legal issues may arise when it comes to the point where municipalities must enforce the I/I reduction program. No matter how successful a program is, there is always the possibility that homeowners will refuse to comply. In this case, municipalities need to have legal means to enforce the requirements of the program whether they are financial or legal, i.e., fines or jail time. If the need should arise, following through on the enforcement of penalties is important. For example, McMinnville, Oregon, has chosen to charge customers who do not complete their prescribed repairs within the 90-day grace period a penalty of \$50 per month until the repairs are completed,

and as an added incentive, customers get a 10 percent rebate if they complete repairs within the 90-day grace period.

4.03 LEGAL CONCLUSIONS

Municipalities that have well-thought-out plans developed with their legal counsel and insurance agent, an effective public awareness program, and an organized execution of the plans are more likely to have successful programs. I/I reduction program plans should consider how to finance a program, how to present the program to the public, how inspectors and contractors will gain access to private property, how much liability the municipality is willing to accept, and who performs the rehabilitation. Prior to implementing a program, municipalities should consult their attorney to make sure that they are within legal boundaries and that they are not taking on more liability than intended. Contracts and financial arrangements with customers should also be developed with the assistance of an attorney.

Public acceptance of the program is critical for program success. Homeowners have been more amenable to programs where line failures are clearly presented through CCTV tapes or other investigative evidence and the need for the repair is explained well. Also, the simpler it is for a homeowner to comply, such as using preselected contractors, the more likely they are to participate in the program.

There are many legal aspects that should be considered during the planning phase of any I/I reduction program. Taking the time to do this early in a project will protect both the municipality and the customers and will lead to a more successful project.

4.04 ORDINANCES

Sewer ordinances originated as a result of Clean Water Act grants that required recipients to implement a EPA-approvable sewer use ordinance. These ordinances include required elimination of illegal inflow connections. As part of this process, many municipalities adopted one of the regional or national plumbing codes, such as the Uniform Plumbing Code (UPC), as a basis for the sewer use ordinance; but these codes do not include provisions for the enforcement, assessment of fines and penalties, and administrative processes associated with compliance. Municipalities should incorporate these elements into their sewer ordinances (WEF, *Control*, 50). Michael Simpson lists eight components of a model ordinance in his WE&T article *It Can Be Done*. These components are shown in the text box on this page and are clearly described in Simpson's article.

Components of a Model Ordinance (WE&T, *It Can Be Done*)

- Rationale/justification for the program.
- Legislative authority and severability.
- Scope and application of the ordinance.
- Prohibited acts and connections.
- Responsibility for compliance.
- Rights of the municipality.
- Available financial assistance and procedures for obtaining financing.
- Appeal rights.

Draft

How a municipality elects to finance the private I/I reduction program can have major impacts on the final outcome. The physical, political, and economic features of the area should be given careful consideration when choosing a financing plan. However, there is no formula to dictate what works and what does not.

5.01 FINANCING ALTERNATIVES

Funding of private source I/I reduction programs can be grouped into four main categories:

- Fully Funded by Municipality
- Fully Funded by Homeowners
- Shared Funding
- Insurance/Warranty Programs (typically only used to address rehabilitation of private laterals).

Table 5.01-1 and Figure 5.01-1 summarize the financing methods used by the 58 public works agencies surveyed in WERF's publication *Methods for Cost-Effective Rehabilitation of Private Lateral Sewers*. The majority of agencies (52 to 56 percent) represented in this report require the homeowners to assume the financial responsibility for inspections, lateral maintenance, lateral rehabilitation, and inflow removal. In approximately one-third (30 to 39 percent) of the programs surveyed, the agencies share in these costs, while only a small percentage of agencies (5 to 17 percent) fully fund these activities.

Additionally, Strand Associates reviewed the private property I/I reduction programs of 68 communities as part of an August 2006 report titled *Inflow and Infiltration from Private Property*. Of these communities, 59 provided information on program funding for I/I reduction programs. Interestingly, the results differed from those found in the WERF study. The costs were shared between municipality and homeowner in 17 percent of the cases. The municipality paid for 100 percent of the costs in 41 percent of the cases, and the homeowner paid for 100 percent of the costs in 27 percent of the cases. In 15 percent of the cases, the municipality used an insurance program to pay for costs. Please note that these are not direct comparisons, as the interpretation of "homeowner funded" varied between the studies. For example, the WERF report considered insurance programs as homeowner-funded programs where the Strand Associates survey identified them separately.

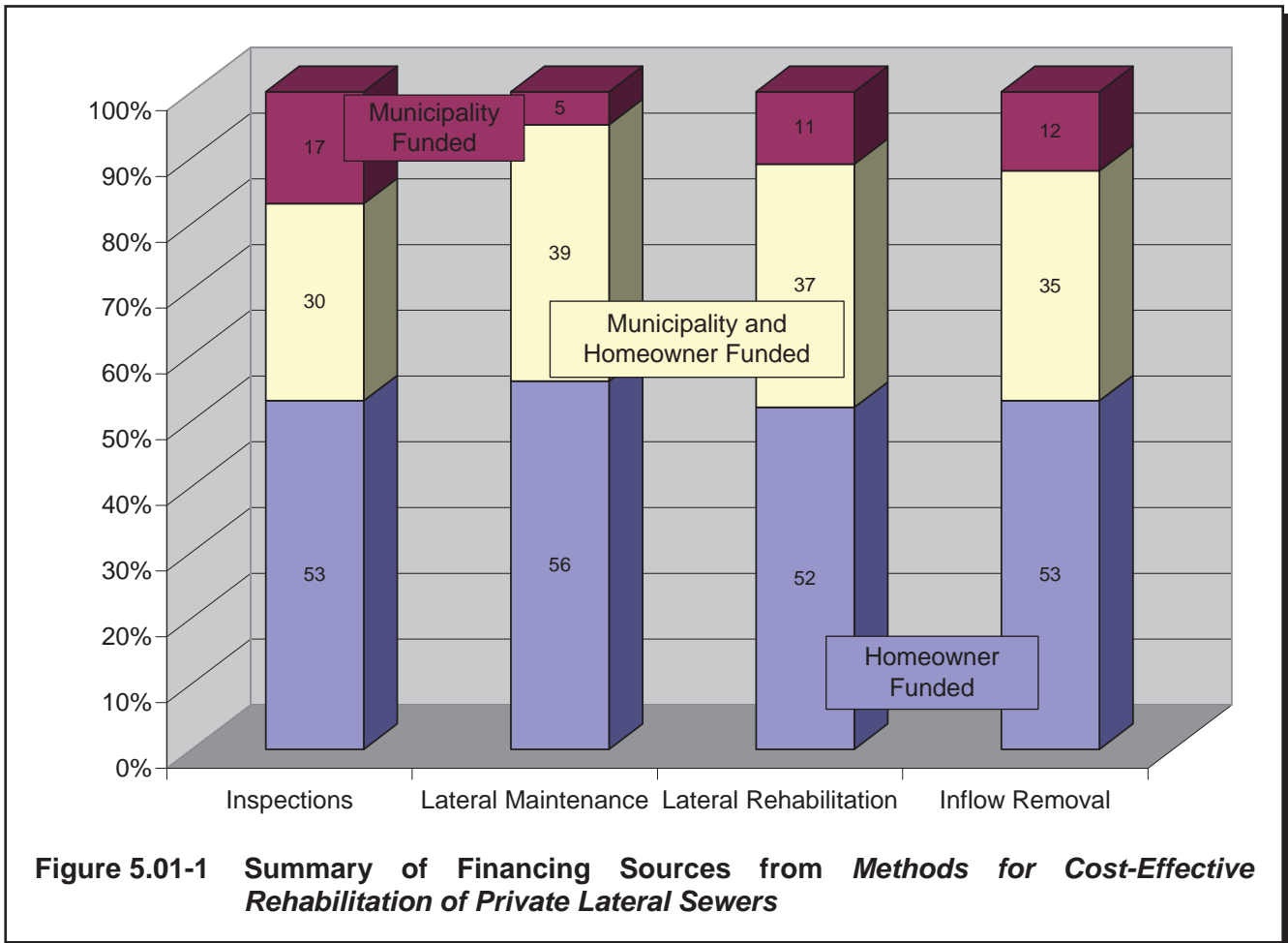
Municipalities using each of the financing schemes have I/I reduction program success stories. Johnson County, Kansas, which reimbursed homeowners for 100 percent of the removal costs for all identified sources of I/I, has received significant national attention as a very successful private source removal program. On the other hand, communities such as Miami Dade, Florida; Lansing, Michigan; and Winchester, Kentucky, require homeowners to assume all costs associated with rehabilitation/removal of I/I sources and still claim successful programs with high participation rates.

TABLE 5.01-1

REPORTED PRIVATE LATERAL FUNDING OPTIONS (Adapted from WERF’s Table 6-2)

No.	Option	Description
1	No funding	Homeowner responsible for maintenance and repair of entire lateral.
2	Lower lateral funding only	Financial assistance provided for lower lateral repairs downstream of the property line and wye connections. Homeowner responsible for upper lateral and part of lower lateral repair up to a maximum cost.
3	Funding for testing only	Agency provides funding for testing of lateral and homeowner is responsible for lateral repair.
4	Voluntary test and repair	Homeowners of a single-family home can volunteer to have their lateral tested and receive a specified funding level for any repair costs and inspection costs.
5	Mandatory test and repair upon sale of home	Prior to sale of home, mandatory testing and any needed repairs are all paid for by the homeowner. A Certificate of Compliance can be issued after repairs that is effective for a specific length of time.
6	First time funding only	City funds the first time that a lateral is repaired with the homeowner responsible thereafter.
7	Deductible funding	Agency provides funding for repairs beyond a set maximum cost and, in some cases, all street, curb, and sidewalk repairs.
8	Insurance funding	Agency makes available insurance to homeowners that covers all or part of the construction cost for lateral repair. These programs can be voluntary or mandatory.
9	Zero interest loan with deferred payback funding	Agency funds lateral repairs through a zero interest loan, which is paid back at the time of house sale.
10	Funding limit by defect	Agency provides full or partial funding for removal or repair of private section, I/I sources, and defects based on type of defect.
11	Full funding	All O&M responsibility is held by the Agency.
12	Warranty	Homeowner purchases an annual warranty and thereby transfers responsibility for all O&M to the Agency. These programs can be voluntary or mandatory.
13	Split funding	Dual responsibility where Agency conducts all O&M activities and shares the costs equally between the Agency and the homeowner.
14	No funding/Agency acts as agent	Homeowner pays but the Agency acts as the agent for the homeowner in coordination of services and hiring of contractors. Responsibility for O&M and all costs are held by the homeowner.
15	Hardship cases	Hardship cases where the Agency provides support on a case-by-case basis only. O&M responsibility is held by the homeowner.

No.	Option	Description
16	Agency inspection/Mandated repair	Agency assesses lateral condition through inspection or I/I study and identifies lateral defects. Agency instructs the homeowner to make appropriate changes with consideration for penalties. O&M responsibility held by the homeowner.
17	Agency inspection/Incentive rebate	Agency inspects laterals as part of sewer reconstruction contracts. Homeowner is advised of defects and fined a set fine per month if the repairs are not completed within a specified time. Homeowners that comply within specified time can participate in an incentive rebate program. O&M responsibility is held by the homeowner.
18	Homeowner required to inspect and provide annual report	Homeowner is advised of O&M responsibility and mandated to provide a periodic inspection report. Agency has the right to conduct inspections on the homeowner’s behalf and charge costs back to the homeowner. O&M responsibility is held by the homeowner.
19	Joint inspection/Homeowner mandated to repair	Homeowner and the Agency inspect assets and the Agency provides the landowner with a report identifying any necessary repairs. The Agency provides a list of authorized contractors and grants the homeowner a set period (e.g., 30 days) to complete the repairs. Noncompliance results in the Agency completing the work and charging the homeowner. O&M responsibility is held by the homeowner.



Other communities such as Lower Paxton Township, Pennsylvania; Normal, Illinois; and Washington County, Oregon, met with limited success until they removed all financial responsibility from the homeowner and used public dollars to pay for the rehabilitation. Once the public agency assumed 100 percent of the costs, the program participation rates in these three communities increased dramatically.

Cost share programs have proven successful in a number of communities including Florence, Kentucky, which pays the first \$1,000 for removal of I/I sources, excluding laterals and foundation drains, and assumes 50 percent of additional costs up to \$2,000 (the City’s contribution is capped at \$2,000). Pittsburgh, Kansas, also has implemented a cost share program that splits the rehabilitation costs with the homeowner up to \$3,000 (the City’s contribution is capped at \$1,500). The program addresses all sources, but the City focuses on sump pumps and downspouts.

5.02 MUNICIPALITY-FUNDED ALTERNATIVES

When a utility is going to pay for 100 percent of the costs relating to an I/I reduction program, they must identify a funding source. I/I reduction programs are funded by municipalities through a number of revenue sources, including:

- General Obligation Bonds—General obligation bonds allow municipalities to borrow funds up to 5 percent of the value of taxable property located in the municipality.
- Property Taxes—Large sewer districts in Wisconsin can increase funding through increased property taxes. Small sewerage districts may raise property taxes up to one mil for each dollar of equalized value of property in the district.
- Special Assessments—Special assessments may be used to generate funding for projects “in a limited and determinable area.” For example, a special assessment could be used for activities on one street. The special assessment may not exceed the value of the benefits accruing to the property.
- Service Charges—Sewer districts may increase service charges to recover costs for capital or operating expenses. These could be a flat fee or penalty-type charge.
- User Charges—User fees may be charged to pay for operating costs. Fees must be proportional to other users based on factors like volume, flow rate, or strength of discharge.
- Insurance or Warranty Programs—These programs collect and manage funds from users to pay for private I/I reduction programs. (WEF, *Private Property*)

Forty-two percent of the agencies in the WERF study used public funds. Of these, 49 percent were from user fees, 18 percent were local funds, 8 percent were state funds, 3 percent were revenue from penalties, and 22 percent were from other funding sources (WERF, 6-8).

Johnson County, Kansas, Wastewater Districts (Kansas City, Kansas, area) has one of the most longstanding successful I/I reduction programs in the country. Private improvements accounted for 40 percent of the total I/I reduction achieved in the program, which reduced the overall I/I peak rate during a 10-year storm by approximately 280 mgd. The program focused on removing illegal connections: foundation drains, storm sump pumps or pits, area drains, downspouts, and defective service line cleanouts. Homeowners were reimbursed for direct costs associated with these disconnections/repairs according to payment schedules published by the District. Additionally, the District prenegotiated prices with local contractors and provided standard specifications. Homeowners were given the option of soliciting a minimum of two bids from a list of preapproved contractors or let the District arrange repairs. This allowed homeowners to have control of the repairs if they so desired and allowed the District to increase efficiency by having contractors work in clusters. By the second year of the program, the District had a disconnection rate of 4,000 per year. The overall I/I reduction program cost \$47 million with \$30 million dedicated to collection system improvements. The private property program was \$11.2 million, and engineering and administrative expenses totaled \$19.7 million.

In conclusion, some municipalities find that using public dollars is the most effective way to address I/I sources located on private property. The disadvantage of this type of program is that the municipality’s scope of work is much broader. In addition to the added management efforts, the

collection system size is greatly expanded. The length of the private laterals can be equal to the length of the public sewer main in some communities. Municipalities should choose whether this is the best alternative for them only after careful consideration.

5.03 HOMEOWNER-FUNDED ALTERNATIVES

Homeowner-funded alternatives include financing programs that put the burden of cost on the homeowner. These programs can be mandatory or voluntary. Homeowners may be responsible for arranging inspections and repairs or they may be assisted by the municipality in some of the arrangements, i.e. preselected contractors or arranged inspections. Some of the more creative homeowner-funded alternatives are warranty or insurance programs. These programs are discussed in Section 5.05.

Some municipalities that have chosen to put the financial obligation completely on the homeowner have seen reasonable success of their programs. Others have had to modify their programs to share costs before seeing any success. Programs that place the financial burden completely on the homeowner seem to rely on monetary and civil consequences for motivation. As previously described, McMinnville, Oregon, requires homeowners to repair laterals if the lateral is identified as a problem. If the lateral is repaired within a 90-day grace period, the homeowner is reimbursed 10 percent of the repair cost up to \$250. If they do not comply within this time period a \$50 per month penalty is charged until the work is completed. If the work is completed within 10 months, the penalty is waived.

5.04 SHARED-COST ALTERNATIVES

Costs can be shared between homeowners and municipalities through a number of methods. Municipalities have chosen to:

- Pay for costs up to a certain amount.
 - The Vallejo Sanitation and Flood District (Vallejo, California) reimburses homeowners according to a fixed-cost schedule for the first lateral repair. Subsequent repairs are the homeowner's responsibility. Cost of the program is recovered from a user fee distributed equally among all users.
 - The City of San Luis Obispo, California, uses their Voluntary Service Lateral Rehabilitation Program to reimburse homeowners for half of the repair costs up to \$1,000. The reimbursement applies to video inspection costs as well.
- Pay for costs above a certain amount.
 - The City of Montgomery, Alabama, offers a financial assistance program that will pay for lower lateral repairs exceeding \$1,200 and, if necessary, repair of the wye connection at

the mainline (regardless of other costs). The homeowner is responsible for upper lateral repairs and lower lateral repairs (other than the wye) below this limit.

- Pay for costs associated with a portion of the lateral (lower lateral or laterals under roads or sidewalks).
 - The City of Phoenix, Arizona, pays for repairs from the property line to the main sewer. The homeowner is responsible for costs from the house to the property line. The City has allocated approximately \$200,000 per year since 1996 for this program.
 - The City of Albany, California, requires homeowners to repair the upper portion of their laterals. If lower lateral repairs are necessary, the City will pay for them.
- Split costs with homeowner.
 - Mobile, Alabama, shares costs for lateral replacement with the homeowners. The City will pay for one cleanout, one pre-construction video, and one post-construction video.

There are many alternatives for municipalities to choose from and there is no one-size-fits-all approach that can be recommended. Each of these alternatives has been met with varying degrees of success.

5.05 INSURANCE/WARRANTY ALTERNATIVES

Warranty and insurance programs collect and save bill payer's funds over time and use the saved funds to pay for inspections and repairs as necessary. These programs collect their funds from initial deposits or one-time fees on an individual bill or monthly fees on regular sewer bills. These programs can be voluntary or mandatory. Once these funds are collected from bill payers, they are earmarked for the municipality's private lateral improvement program.

In these programs, homeowners pay into the warranty or insurance fund, and the funds are used to pay for all or a portion of the repairs. These programs are widely used in the St. Louis, Missouri, area. Seventy of 92 communities in the St. Louis Metropolitan area have Lateral Insurance Programs. Of these 70 programs, 37 assume 100 percent of the repair cost while 33 employ a cost share approach between the insurance fund and the affected resident. Mishawaka, Indiana, added a \$0.50 fee to the sewer utility bill to fund 100 percent of the repair costs over \$250 for all users. Riverton, Wyoming added a \$2.95 fee per month to the sanitary sewer bill to help fund a Sewer Lateral Protection Plan. This lateral program is a voluntary program for all users of the wastewater utility.

By collecting money from users upfront or periodically, utilities with insurance or warranty programs avoid the challenges associated with asking users to pay large sums of money to repair their laterals. These programs also have the potential to earn interest on the insurance or warranty funds.

5.06 REAL COST OF PRIVATE PROPERTY I/I

No matter what the implementation plan, private property I/I affects municipalities whether or not they take action. Should a municipality embark on a mission to identify and reduce private property I/I, the municipality or their homeowners will incur additional costs. These costs will be through increased billing, debt on the municipality’s side, or costs directly paid by the homeowners for inspections or repairs. Should they decide to do nothing, the municipality will incur the increased costs of conveyance, treatment of the I/I flow, and potential fines for sewer overflows. Additionally, the I/I flow could be so significant that it would require a plant expansion earlier than would otherwise be necessary.

Action	
Expenditures	Savings
Inspections	Reduced Cost of Treating I/I
Lateral Repairs	Potential to Delay Capitol Expenditures
Coordination Costs	Moratorium Relief
Increased Paperwork	Reduced Cleanup Costs for Basement Backups and Flooded Pump Stations
Processing Payments	
No Action	
Expenditures	Savings
Cost of Treating I/I	No Inspections
Potential Capital Improvements	No Repairs
Reduced Plant Capacity Availability	No Increased Paperwork or Funding Management
Cleanup Costs for Basement Backups and Flooded Pump Stations	

Table 5.06-1 Monetary Differences Between Action and No Action Approaches to Private Property I/I

Table 5.06-1 is a summary of the monetary differences between action and no action plans. The section on Economic Issues in WEF’s *Control of Infiltration and Inflow in Private Building Sewer Connections* contains a thorough discussion of the real cost of private property.