ARTICLE 8: INFILTRATION / INFLOW CONTROL PROGRAM

INTRODUCTION (§800)

Major components of the **sanitary sewer** system are the public sewer mains (mains) and privately-owned sewer laterals (PSLs). Both contribute infiltration and inflow (I/I) to the **sanitary sewer** system. Significant I/I flow causes **sanitary sewer overflows** (**SSOs**), damage to private property through **basement backups** (**BBs**), loss of conveyance capacity and an increase in wastewater conveyance and treatment costs. The **sanitary sewer** system is designed to convey only wastewater, not wet weather flows or excessive **groundwater** that infiltrates into the sewers. When intense rain events occur and **groundwater** and **stormwater** enter the **sanitary sewer** system, the sewer becomes overloaded and capacity is exceeded, leading to **SSOs** and **BBs**. To prevent this from occurring, the **District** is implementing an Infiltration/Inflow Control Program with which all **satellite entities** must comply. The effective date of the Infiltration/Inflow Control Program described in §801 through §806 is July 10, 2014.

Infiltration

Infiltration removal/reduction addresses **groundwater** entering defective sewer systems. Sewer system defects that allow infiltration include pipe cracks, open/offset joints, open connections, etc. Removal/reduction of infiltration sources is generally accomplished by rehabilitation (repair/replacement) of the sewer system. Additional advantages to rehabilitation include restoring the structural integrity of the system, increased hydraulic capacity and the prevention of tree root intrusion.

Inflow

Inflow removal/reduction addresses **stormwater** and **groundwater** conveyance systems that are connected to the **sanitary sewer** system. Conveyance systems that contribute clear water inflow into the **sanitary sewer** system include downspouts, foundation/footing drains, sump pumps, area drains, etc. Removal/reduction of inflow sources is generally accomplished by disconnection from the **sanitary sewer** and rerouting of discharge into a **stormwater** conveyance system or redirecting discharge flows at grade. Figure 8.1 illustrates the most common sources of clear water into the **sanitary sewer** system. Figure 8.2 is a graphical representation of the components of wet weather flow in a sanitary sewer.

Note: All bold terms contained in this document are defined terms in the WMO. Refer to Appendix A of the WMO or the TGM for the definition of each bold term.

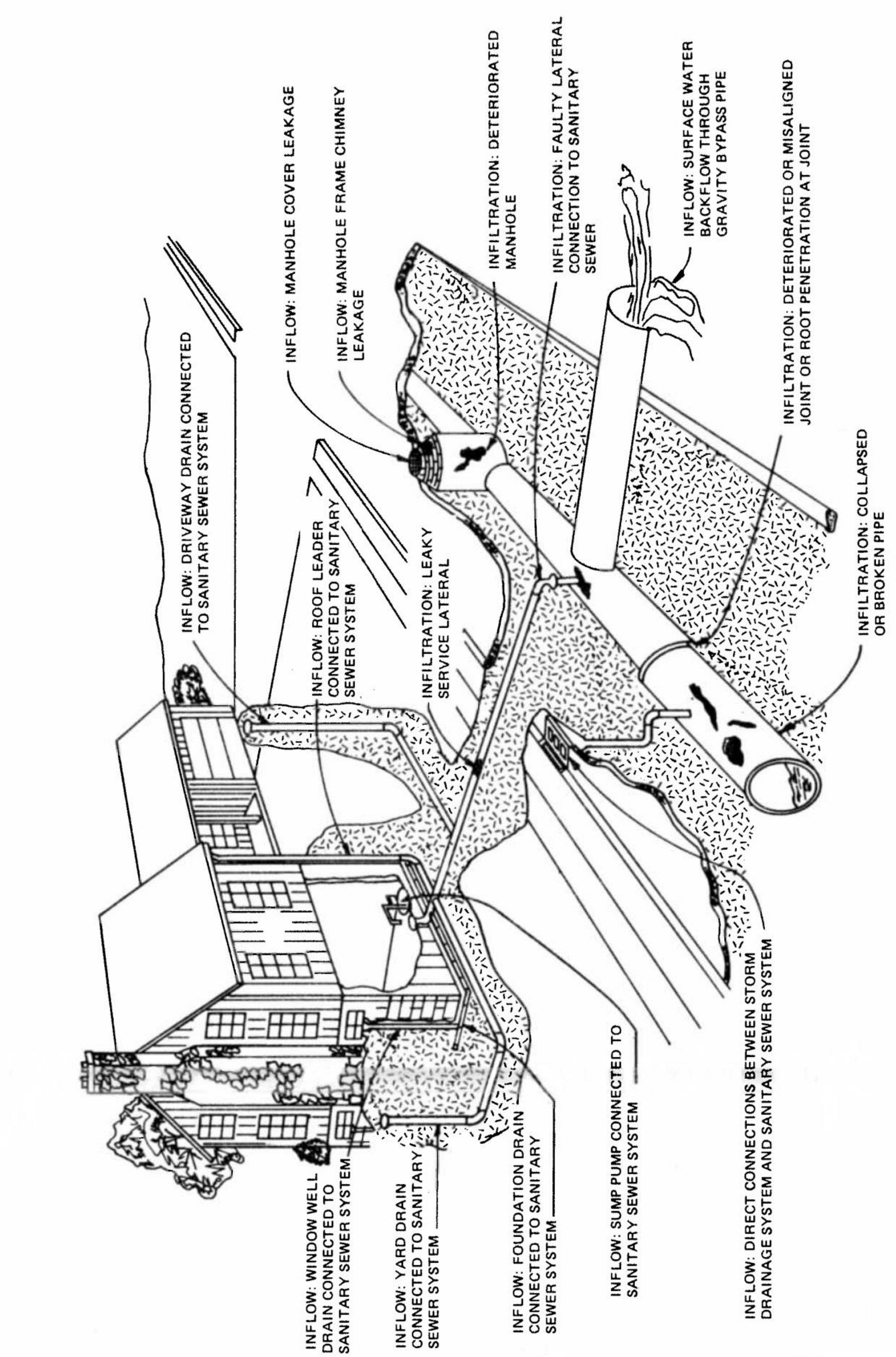

Figure 8.1. Typical Sources of Infiltration and Inflow

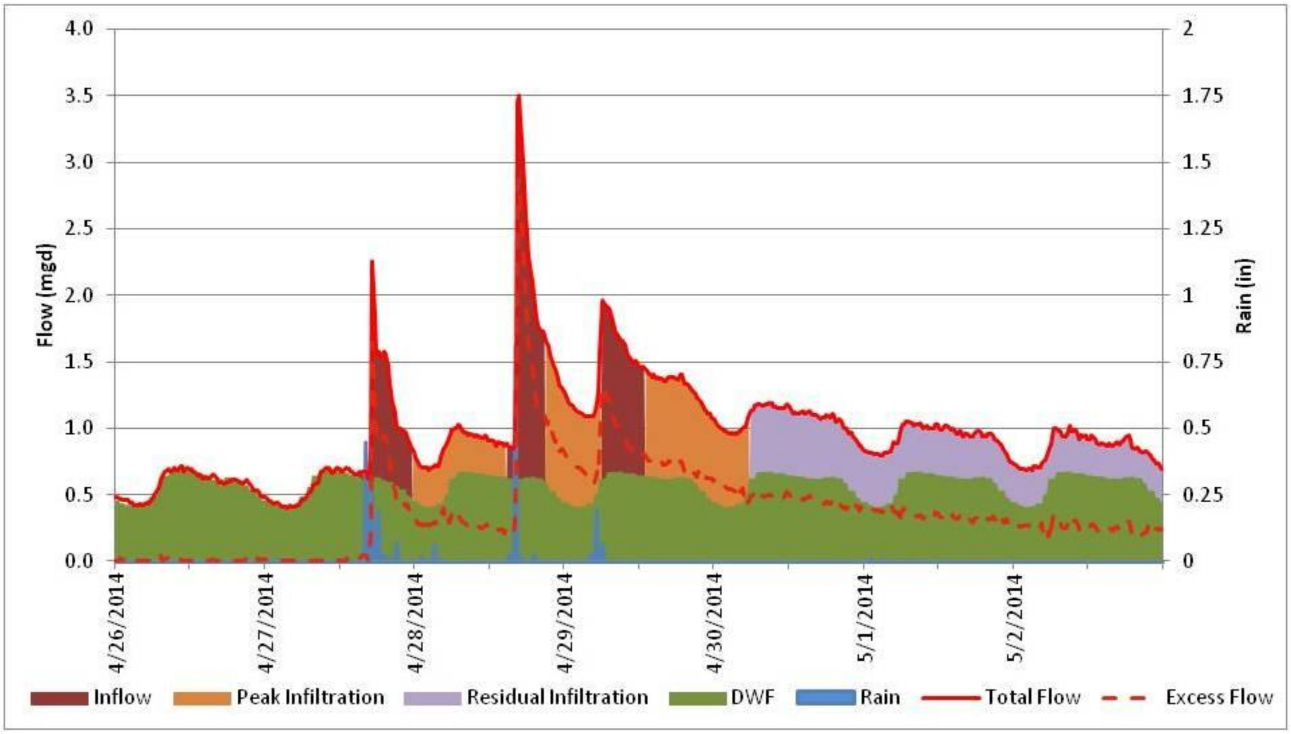

Figure 8.2.Typical Components of Rainfall-Derived Inflow and Infiltration

History of Infiltration and Inflow Control Programs at the District

The **District** serves both **combined sewer areas** and **separate sewer areas**. Permits issued by the **District** allowing local sewer system owners to connect to **District** interceptors dating back to 1920 contain language prohibiting surface water from entering the **sanitary sewer** system. Although such language was included in the **District's** permits issued in **separate sewer areas** since that time, excessive I/I in the **District's** system became a growing problem. The Federal Water Pollution Control Act, as amended on October 18, 1972 by Public Law 92-500, required all applicants for treatment works grants from **USEPA**, after July 1, 1973, to demonstrate that each sewer system discharging into such treatment works is not subject to excessive infiltration/inflow. This requirement motivated the **District** to amend the **Manual of Procedures** for the Administration of the **Sewer Permit Ordinance** (MOP) in 1972 to include Article 6.5, which became effective January 1, 1973. Article 6.5 contained the **District's** I/I control program which included the following requirements:

- Within one year of the effective date, all **satellite entities** had to inspect all structures for directly and indirectly connected downspouts, and have all such downspouts properly disconnected from the **sanitary sewer** system.
- Within one year of the effective date, all **satellite entities** had to inspect their public systems for inflow sources and remove such sources.
- All **satellite entities** were to submit quarterly progress reports.

Initially, the **District** required **satellite entities** to demonstrate that average daily wet weather flow in the **sanitary sewer** system did not exceed 100 gallons per capita per day. In the 1970s, at the request of satellite system owners, the **District** raised the maximum allowable wet weather flow rate to 150 gallons per capita per day. Areas that were served by **combined sewer** systems were exempt from this program because excessive wet weather flows would, in theory, be captured by the **Tunnel and Reservoir Plan (TARP)**.

Many **satellite entities** took advantage of grant money offered by **IEPA** to hire consultants to prepare Sewer Systems Evaluation Studies (SSES). An SSES was necessary to receive grant funds for sewer rehabilitation. Once a scope of work was defined as a result of an SSES, a satellite system owner would hire contractors to perform required rehabilitation work on the public sector sewer system. One condition of receiving these grants was that sewer system owners agreed to adequately maintain their sewer system going forward.

Despite the easing of requirements under the initial I/I control program, most **satellite entities** found the compliance criteria too difficult and costly to achieve and appealed to the **District Board of Commissioners** to consider a program that emphasized the cost effectiveness of reducing I/I instead of having an absolute goal. In 1985, a series of meetings were held between elected local officials and representatives of the **District**, **IEPA** and **USEPA** on the matter of **sanitary sewer** rehabilitation. This led to the **Sewer Summit Agreement** (**SSA**) which established guidelines and a schedule for achieving final compliance with **sanitary sewer** rehabilitation requirements that were acceptable to all of the involved parties. The **Board of Commissioners** adopted the **SSA** on November 21, 1985 and Article 6.5 of the **MOP** was amended to reflect the new Infiltration/Inflow Corrective Action Program (ICAP) option, in addition to the existing compliance criteria, which was referred to as the 150 gallons per capital per day (gpcpd) option.

Under the ICAP option, satellite system owners had to perform an evaluation of their system, and an SSES, which included a cost-effectiveness analysis of specific I/I removal measures. The cost of I/I removal was compared to the cost to transport and treat excess flow, if the I/I was not removed. The SSES also calculated a projected post-rehabilitation wet weather flow rate, following implementation of cost-effective I/I removal measures. Satellite systems were required to implement these measures and then perform post-rehabilitation flow metering to demonstrate the reduction in I/I. Satellite systems were also required to develop a **Long Term O&M Program (LTOMP)** addressing both the public and private sectors. Finally, satellite systems were required to submit annual summary reports after achieving compliance with ICAP.

The **District** was obligated to conduct analyses of each basin to assess the impact of the wet weather flow expected to remain in the system after satellite systems performed the required cost effective I/I removal work. In order to handle the review of the SSES from all satellites, review programs initiated by the satellites, and review certificates of compliance, the **District** contracted with Donohue and Associates and with Metcalf and Eddy to provide an extension to in-house staff. Donohue conducted the basin analyses and Metcalf and Eddy developed the <u>Operations and</u>

Maintenance Manual for Separate Sanitary Sewer Collection Systems for Local Agencies Tributary to the Metropolitan Sanitary District of Greater Chicago ("1989 Manual").

Despite the considerable effort and resources spent towards removing I/I under ICAP and the 150 gpcpd, the **District** still experiences high flows during wet weather from **separate sewer areas**. This is particularly evident at the **District's** treatment plants that serve only separate sewer systems (Hanover Park Water Reclamation Plant (WRP) and Egan WRP) and at the Lemont WRP, that serves a predominantly separate sewer system. In addition, the **District** is at risk of enforcement measures by regulators should **SSOs** occur within its system. Furthermore, satellite system owners have voiced concerns about evidence of excessive wet weather flow in the form of **SSOs** and **BBs** within their own systems.

The **IEPA** issued draft versions of **NPDES** operating permits for the **District's** Calumet WRP, North Side WRP and Stickney WRP in 2009 for public comment. These draft permits contained a new Special Condition addressing the **District's** I/I control program. The Special Condition stated:

> "In the event that local sewer system owners have excessive I/I (any wet weather flows exceeding 150 gpcpd 24-hour average with peak flow not to exceed 100 gpcpd times an allowable peaking factor in accordance with the Illinois Recommended Standards for Sewage Treatment Works) in their separate sewer systems that cause or contribute to basement back-ups and/or sanitary sewer overflows, the Permittee shall require that the local sewer system owner implement measures in addition to those required under the Sewer Summit Agreement in an effort to reduce the excessive I/I. Such additional remedies may include sewer system evaluation studies, sewer rehabilitation or replacement, inflow source removal, and restrictions on the issuance of additional sewer connection permits. A summary of such additional measures shall be included with the Sewer Summit Agreement Report."

This language allowed the **District** to require additional effort on the part of satellite system owners to reduce I/I under certain circumstances. Although the **IEPA** did not issue the **NPDES** permits containing this Special Condition until 2013, the **District** formed an Advisory Technical Panel (ATP) in 2011 to discuss elements of a new I/I control program. The ATP is comprised of representatives from the **USEPA**, **IEPA**, **municipalities**, sanitary districts, townships, a utility company, a sewer construction contractor, consultants, and **District** staff. The ATP met regularly throughout 2011, 2012 and 2013, and has provided insight and valuable perspective on elements of a new I/I control program proposed by the **District**. On July 10, 2014, the **District** adopted a new I/I control program, which is described below. The ATP's comments will be sought on the development of technical guidance on this program, and any future modifications of the program will be presented to the ATP.

SCOPE AND GOALS (§801)

The purpose of this program is to reduce **SSOs** and **BBs**, comply with the **District's NPDES** permit requirements and to eliminate extraneous flows to the **District's** facilities by the formation and adoption of an I/I Control Program (IICP). The IICP will require **satellite entities** to identify and address I/I sources within the public and private sewer system. This will be accomplished by the individual **satellite entities** developing and continually implementing their own **Long Term O&M**

Program (**LTOMP**) and **Private Sector Program** (**PSP**). Satellite system owners are in the best position to know what actions need to be taken to eliminate **SSOs**, **BBs**, and excessive wet weather flow. Therefore, latitude is offered under this program to satellite system owners to determine those actions that will effectively reduce excessive I/I. Further information regarding these programs is provided in §803, §804, and §805.

APPLICABILITY (§802)

The IICP applies to all **satellite entities** that are located within the **separate sewer area** (areas with separate sewers designed for wastewater and **stormwater**) that are directly and/or indirectly tributary to the District's facilities. The IICP also applies to the portions of local sewer systems located in the designated **separate sewer area**, when a local sewer system consists of both combined and separate systems. Separate sewer systems within the City of Chicago are exempt from the IICP.

GENERAL REQUIREMENTS (§803)

The IICP will be implemented by all **satellite entities** to reduce **SSO**s and **BBs**, and to reduce excess wet weather flow in the **sanitary sewer system**. This will be accomplished through Short Term Requirements, a **Private Sector Program (PSP)** and a **Long Term O&M Program**, and annual reporting of activities planned and performed to meet these requirements.

SHORT TERM REQUIREMENTS (§804)

Within the first five years of the effective date of the IICP, all **satellite entities** must complete the Short Term Requirements detailed herein. All **satellite entities** must conduct a condition assessment of their sewer system, undertake rehabilitation work to address I/I sources, and develop and submit their individual **LTOMP** and **PSP** to the **District** for approval.

Sewer System Condition Assessment

Condition Assessment Prioritization

The undertaking of the sewer system condition assessment is the first step in identification of I/I sources that lead to **SSOs** and **BBs**. At a minimum, the condition assessment must include all of the high risk public **sanitary sewers**. Satellite system owners shall determine the extent of high risk public **sanitary sewers** within their systems. This determination must be completed by the time the first Short Term Requirements Annual Report (described below) is submitted to the **District**, as it defines the scope of condition assessment activities for the first five years of the IICP.

Public sewers in the following areas may be considered high risk **sanitary sewers**:

A. Areas with **SSOs** and/or **BBs**;
B. Areas upstream of **SSOs** and **BBs**;
C. Subbasins known to surcharge;
D. Areas with excessive wet weather flows and/or excessive lift station pumpage; and
E. Areas with system deficiencies that could result in system failure.

Areas with SSOs and/or BBs are subbasins within a **sanitary sewer** system that have experienced one or more **SSO**s and/or **BBs** that have not been attributed to problems with the private **sanitary sewer** (such as a clogged private lateral), and that have not been resolved through rehabilitation or **maintenance** activities on the public sewer (such as sewer cleaning, sewer lining, point repairs, private sector improvements, etc.). Areas with more widespread and frequent **BBs** and **SSOs** should be addressed with a higher priority than areas with fewer **BBs** and **SSOs**.

Areas upstream of SSOs and BBs are subbasins that discharge into a public sewer upstream of the point where a subbasin with **SSO**s and **BB**s, as defined above, discharge into a public sewer. In Figure 8.2, if Subbasin 2 experiences **SSO**s and/or **BB**s, Subbasin 1 is considered an area upstream of an area with **SSOs** and **BBs**, since it discharges into the same **sanitary sewer** main line further upstream, and could contribute to **SSOs** and **BBs** in Subbasin 2.

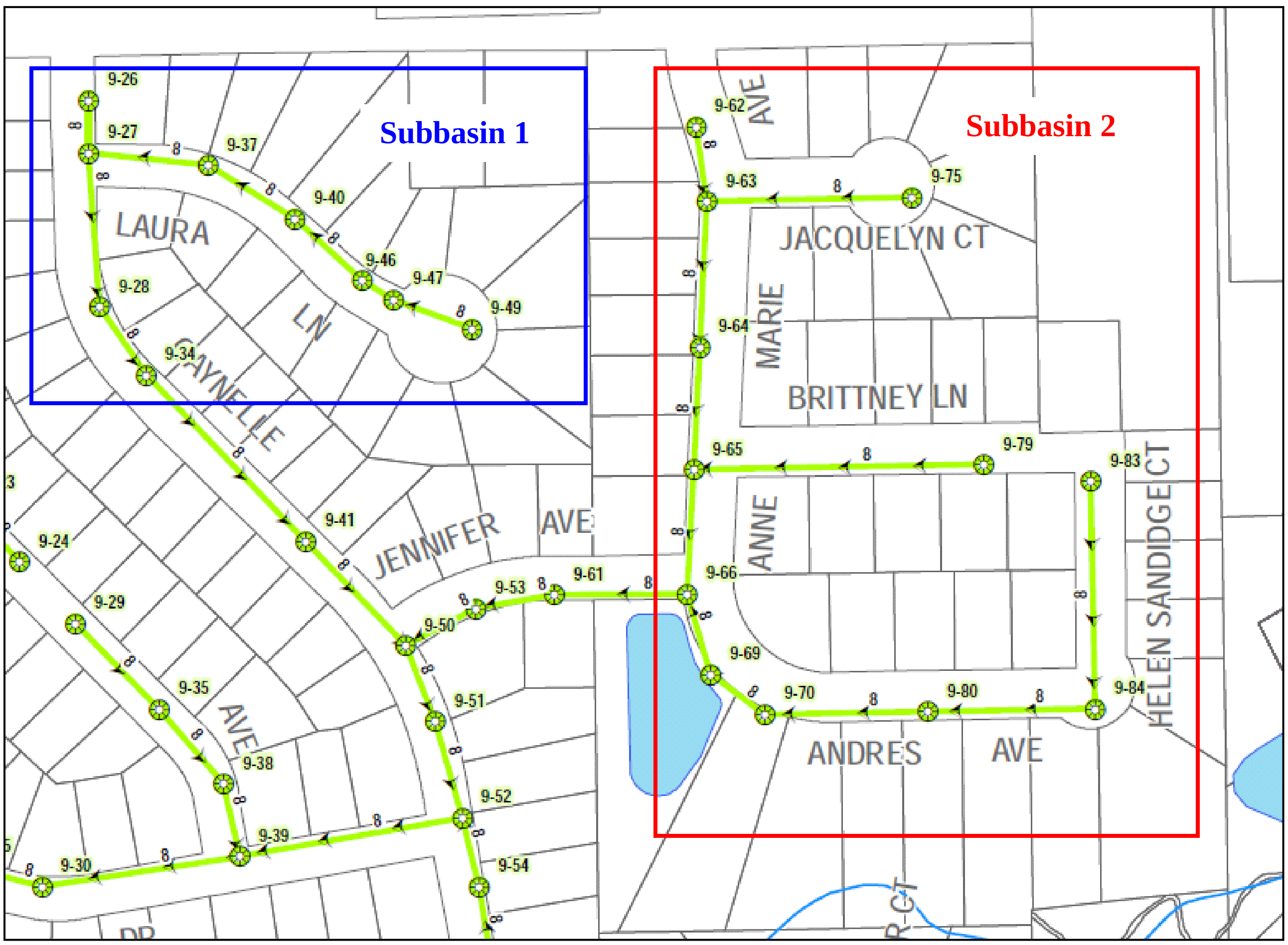

Figure 8.3. Subbasins Tributary to the Same Sanitary Main Line (Courtesy of the Village of Tinley Park)

Subbasins known to surcharge include areas where the satellite sewer system owner has knowledge of incidences of the hydraulic grade line in **sanitary sewers** exceeding the elevation of the crown of the sewers on an annual or more frequent basis. Such conditions would be ascertained through **sanitary sewer** flow metering, level measurement in manholes, and/or observations of **SSOs** and **BBs**. Although new flow metering is not required as part of this program, satellite system owners that have previously conducted flow metering may use the information collected to identify areas known to surcharge. If satellite system owners wish to conduct flow metering under the IICP to determine the severity and extent of surcharging in their systems, they are encouraged, but not obligated, to do so.

Areas with excessive wet weather flows include areas experiencing **SSOs**, **BBs** and/or surcharging as described above, but also include areas where flow metering has identified wet weather flows with peaking factors of 4 or greater, in the absence of other indicators of excessive wet weather flow. A peaking factor is the maximum wet weather flow rate at a particular location in the **sanitary sewer** divided by the dry weather flow rate at that same location. A description of how to conduct flow metering and determine peaking factors is provided in §805 of this document. Areas with larger peaking factors should be addressed with a higher priority than areas with lower peaking factors. As stated above, flow metering is not required under the IICP, but satellite system owners are encouraged to use reliable flow metering data obtained previously, or to conduct new flow metering - at their sole discretion - to determine wet weather peaking factors in their system.

Areas with excessive lift station pumpage include areas tributary to a sanitary lift station where the discharge flow rate from the lift station exceeds the rated capacity of the lift station, on occasion during wet weather. Sanitary lift stations are sized to accommodate dry weather flow. Although lift stations are designed to have redundant pumps, simultaneous operation of redundant pumps during wet weather to prevent or minimize a rising water level in the wet well is an indication of excessive I/I within the **tributary area**. Lift stations that have force main discharge pressure meters can be used to quantify peaking factors according to the method described in §805. Lift stations that only have event recorders, and no discharge pressure meters, cannot be used to quantify peaking factors.

Areas with system deficiencies that could result in system failure include areas with structural and/or operation and **maintenance** defects that allow significant I/I into the system or indicate high likelihood of sewer collapse or blockage that may lead to **SSOs** and/or **BBs**. Portions of the **sanitary sewer** system with defect grades of 4 or 5 according to the National Association of Sewer Service Companies (NASSCO) pipeline assessment guidelines are examples of such areas. Additional information about the NASSCO condition assessment guidelines is provided below.

Satellite system owners may use additional criteria to determine which portions of the public **sanitary sewer** system are considered “high risk.” Any additional criteria must be described on the *Condition Assessment Prioritization Form* to be attached to the *Short Term Requirements Annual Summary Report Form* that is submitted to the **District**. Satellite system owners must explain the criteria they use to define high risk sewers within each of the aforementioned types of areas. If a satellite system does not include one of the aforementioned types of areas, then this must be indicated on the *Condition Assessment Prioritization Form* and a reason provided. Although portions of the sewer system may be grouped into more than one type of area, these portions must be listed under only one type of area shown on the form. For example, areas with **SSOs** and

BBs are also subject to surcharging, but such areas should only be listed in one row of the table. In no case shall less than ten percent (10%) of the **sanitary sewer** system be assessed over the five-year period preceding the effective date of the **LTOMP**. Figure 8.4 is an excerpt of a section of the *Condition Assessment Prioritization Form*, filled out as an example showing how a satellite sewer owner might prioritize the high risk **sanitary sewers** within the system. A map showing which sewers are high risk and the extent of the areas served by those sewers must be attached to the *Condition Assessment Prioritization Form*. This map should also show the full extent of the satellite system's service area. This map should be updated to show which areas have been inspected in the reporting year, and should be attached to each Short Term Requirements Annual Summary Report. Maps attached to subsequent submittals of the Short Term Requirements Annual Summary Report should identify areas that have been inspected in previous years since the effective date of the IICP as well.

Type of Area	Present In System (yes/no)	Prioritization Criteria	Linear Feet of High Priority Sanitary sewer to be Assessed in Short Term
Areas with SSOs and/or BBs	Yes	High risk areas have had SSOs and/or BBs reported during 1-year rain events and/or dry weather.	50,000
Areas upstream of SSO/BB areas	Yes	Not high risk. All have been lined in last 15 years. All manholes have been inspected and those allowing I/I have been rehabilitated in last 15 years.	0
Subbasins known to surcharge	Yes	High risk areas have surcharged in 1-year rain event.	50,000(1)
Areas with excessive wet weather flows, other than those listed above	No	Same as areas with SSOs and BBs. No flow metering has been performed to identify other areas with excessive wet weather flows.	0
Areas with excessive lift station pumpage	Yes	Not high risk. Public sewer in area tributary to pump station has been lined over past 10 years. Excessive lift station flows due to private sector I/I.	0
Areas with deficiencies that could result in system failures	Yes	H_2S corrosion evident in 15" main along Cambridge Street between First Ave. and Eighth Ave. This is high priority.	4,400
Other	Yes	Odor complaints submitted every week in dry weather along Gardner Street.	2,000
Total length of public sanitary sewers (feet):			1,000,000
Total length of High Priority sanitary sewer to be assessed in short term (feet):			106,400
Percentage of public sanitary sewer system to be assessed in short term:			10.64%

(1)This total excludes areas with SSOs and BBs listed in the first row.

Figure 8.4. Sample Section from Condition Assessment Prioritization Form

Credit may be given for condition assessment of high risk sewers that has been completed within the five-year period preceding the effective date of the IICP. Should a satellite system have performed such assessments within the preceding five years, they must provide documentation that the work was completed and that NASSCO coding standards were used to code the defects. A report of such assessments in the NASSCO standard format, indicating the date of the televising, manhole inspection, smoke testing or dyed water testing, date of the assessment, name and certificate number of the person performing the assessment, and the individual findings, is acceptable documentation. To obtain credit for the previous work, submit the documentation to the **District** with the Short Term Requirements Annual Summary Report. If a **satellite entity** has completed rehabilitation work to address deficiencies identified during these pre-IICP assessments, that work shall be indicated on the Short Term Requirements Annual Summary Report. A sample of a completed Short Term Requirements Annual Summary Report is included in Appendix D.

If a **satellite entity** has inspected and performed rehabilitation through CIPP lining of a high risk public **sanitary sewer** and associated manholes more than five years before the effective date of the IICP, but still considers the sewer to be high risk, the **satellite entity** may request a waiver from the requirement to televise the rehabilitated public sewer and inspect manholes in this high risk area. Smoke testing of the public sewers and follow-up dyed water testing and external property inspections as described below will still be required in areas served by the rehabilitated high risk **sanitary sewers**. Furthermore, the **satellite entity** will need to televise an equivalent length of public sewers that have not been rehabilitated, but may be sources of significant I/I, and perform inspections of the associated manholes, as part of the Short Term Requirements. This waiver must be requested in a letter submitted to the **District** with the completed *Condition Assessment Prioritization Form*. The map submitted with the *Condition Assessment Prioritization Form* must clearly indicate the location of the:

- Rehabilitated high risk sewers that will be smoke tested and dyed water tested;
- The areas tributary to these rehabilitated high risk sewers;
- Unrehabilitated high risk sewers to be televised/inspected, smoke tested and dyed water tested; and
- Unrehabilitated non-high risk sewers to be televised/inspected only.

The waiver request letter must state when the rehabilitation work was performed and the method of rehabilitation used.

Once the **District** approves the waiver request and proposed plan for condition assessment, the **satellite entity** should report its progress on the Short Term Requirements Annual Summary Report and Status of High Priority Deficiencies forms, as described later in this chapter.

As indicated above, the definition of high risk public sewers shall be completed by the time the first Short Term Requirements Annual Summary Report is submitted to the **District**. Revisions to the definition of high risk public sewers can be made, if, for example, wet weather events that occur after the first year indicate that additional areas are susceptible to **SSO**s and **BB**s. Such revisions will be considered by the **District** on a case by case basis. Declassification of an area as high risk due to a lack of rain and subsequent reduction in **SSO**s and **BB**s will not be allowed. Any revisions to the definition of high risk public sewers must be described in a narrative attached to the Short Term Requirements Annual Summary Report.

<u>Condition Assessment</u>

Once the high risk sewers have been identified, each satellite system owner must conduct a condition assessment of the elements of the **sanitary sewer** system within the high risk areas. Assessment of all high risk sewers must be completed within five years of the effective date of the IICP. All condition assessment work shall be reported to the **District** on the *Short Term Requirements Annual Summary Report Form*.

At a minimum, condition assessment under the Short Term Requirements of the IICP shall consist of:

- Televising all high risk public sewer lines;
- Inspection of all manholes in high risk areas;
- Inspection of all lift stations in high risk areas;
- Smoke testing all high risk public sewer lines;
- Conducting dyed water testing in high risk areas where:
    - **Storm sewer**s or storm ditches run parallel to or cross the **sanitary sewer**s and service laterals and are located above the **sanitary sewer** system and where prior smoke testing has indicated the possible location of a cross-connection;
    - Streams, drainage ditches and areas subject to ponding are located above the **sanitary sewer** system and where prior smoke testing has indicated the possible location of a cross-connection, downspouts are discharged below ground and may be connected to the **sanitary sewer** system, and smoke testing could not confirm or rule out such a connection; and
- Conducting follow-up external property inspections in high risk areas that have previously been smoke tested to determine whether downspouts that discharge below ground but that did not smoke are connected to the **sanitary sewer** and to determine the exact condition of cleanouts that did smoke.

Inspections of the public **sanitary sewer** system must be conducted in accordance the NASSCO standards for Pipeline Assessment and Certification Program (PACP®), Manhole Assessment and Certification Program (MACP®), and Lateral Assessment and Certification Program (LACP®) (where applicable). Smoke testing shall also be conducted in accordance with NASSCO standards. A description of methods for conducting condition assessments and related guidance is provided below.

If a satellite system owner has an inspection program already in place on the effective date of the IICP that does not adhere to NASSCO standards, and the satellite system owner believes his or her program accomplishes substantially similar goals as the NASSCO standards, the satellite system owner may request that the **District** allow his or her existing inspection program to continue to be used instead of a NASSCO program. This request must be submitted to the **District** by the time the first Short Term Requirements Annual Report (described below) is submitted to the **District**. Such a request must include a narrative description of the existing program, written standards for inspection of facilities and classification of defects by severity including whether they are high risk defects, a description of training requirements for staff conducting the inspections, and inspection forms. If the **District** concurs that the existing inspection program is substantially similar to NASSCO's programs and that classification of defects occurs according to standards, then the satellite system will be allowed to continue using its system.

Background on Condition Assessment Methods

Standardization of the condition inspection and assessment procedures under the IICP will provide for the following:

- Uniform inspection standards based on current technology coupled with uniform classification of main sewer, and manhole defects under the NASSCO coding system will provide for uniform reporting, and assessment of compliance with **District** requirements for all of the **satellite entities**.
- Consistency in the development of Short Term Requirements rehabilitation costs by satellite system owners.
- Equitability among **satellite entities** and credit for those that have already conducted investigation/rehabilitation work.
- Standardization of rehabilitation work eligible for **IEPA** SRF funding, and possible **District** funding.
- Consistency in annual reporting to **District** of completed rehabilitation.

Condition inspection standards for **satellite entities** were first established in 1989 as part of the **District** ICAP program (See 1989 Manual). Since the publication of this manual, new condition inspection technologies and national standards for classification and coding of I/I defects have been developed and refined. NASSCO has developed a standard **sanitary sewer** defect identification and numerical coding system for **sanitary sewers**, manholes and service laterals. This coding system has been in place since 2001, and is supported by a network of certified trainers. NASSCO coding standards are now a common requirement of **USEPA**/Department of Justice Consent Decrees.

Closed Circuit Television Inspection (CCTV)

Television inspection involves pulling a television camera through a sewer while an operator observes recorded footage on a computer monitor via closed circuit television signals. Figure 8.5 shows examples of defects in sewers identified by CCTV inspection. Basic procedures for conducting CCTV are addressed in the 1989 Manual on pages 4-7 to 4-11. In addition to procedures addressed in this manual, television inspection must meet the requirements of NASSCO PACP® (Pipeline Assessment and Certification Program - Current Version). Sewer inspection by CCTV will permanently document the condition of the sewer. The video can then be reviewed and the sewer assessed by NASSCO defect coding.

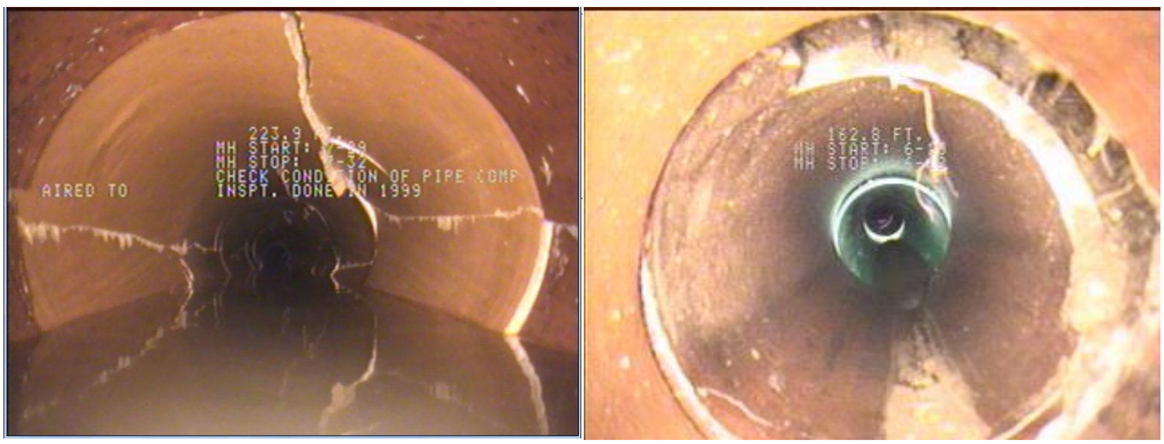

Figure 8.5. High-Priority Mainline Pipe Defects - Left: Multiple Fracture; Right: Hole

Television inspections should also include the following procedures:

- Operators performing CCTV and software shall have current certification by NASSCO for PACP®.
- Cameras shall be color with pan and tilt capability and capable of turning at right angles to pipe's axis (minimum pan of 270 degrees and minimum rotation of 360 degrees). Cameras may also be equipped with digital sidewall scanning capability.
- Sewer condition shall be reviewed at no greater than 30 feet per minute while stopping at all lateral connections and mainline defects.

Satellite entities are encouraged to utilize GIS technology as a part of the **LTOMP**. Data collected from televising inspections (attribute and defect) should be delivered in a database format capable of integration into industry standard GIS systems. Defects and attributes shall be measurable from either the upstream or downstream manhole. Digital audio, video and photographs should be linked in the database to the pipe segments inspected.

Manhole Inspection

Basic procedures for conducting manhole inspections are addressed in the 1989 Manual on pages 4-3 to 4-7. Manhole components and typical clear water entry points are illustrated in Figure 8.6.

Examples of manhole defects identified during inspections are shown in Figure 8.7. As stated above, in addition to procedures addressed in the 1989 Manual, manhole inspections must comply with the current version of NASSCO's MACP®, and should include the following procedures:

- Full descent inspections
  Manhole conditions including manholes greater than twelve feet deep, manholes with significant debris, manholes with structural conditions that may require immediate rehabilitation, or manholes where accurate rim to invert elevations are required for system modeling should be inspected by full descent procedures.
- "Pole camera" (remote)inspections
  Manhole conditions including manholes greater than twelve feet deep, manholes with significant debris, or manholes with structural conditions that may require immediate rehabilitation, could also be inspected by "pole camera" procedures.
- Surface Inspections
  Manholes with none of the above conditions could be inspected by either surface inspection, full descent or "pole camera" procedures. Surface inspections can be effective for identifying defects and manhole conditions in the top portions of the manhole. Surface inspections should be performed in accordance with NASSCO Level 1 Manhole Inspection procedures.

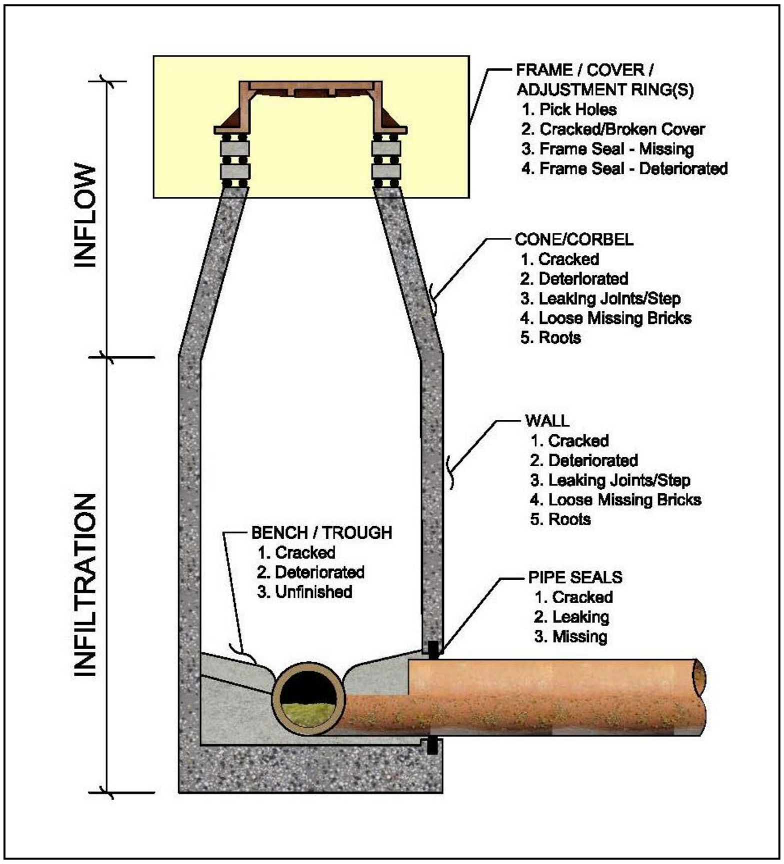

Figure 8.6. Components of a Manhole with Correlate Defects

Manhole inspections should be documented by video and/or photographs. This method will permanently document the condition of the manhole. The video and/or photographs can then reviewed and the manhole assessed using MACP® defect coding.

Figure 8.7. High-Priority Manhole Defects – Left: Deteriorating Brickwork; Right: Deteriorated Adjustment Ring

Data collected from manhole inspections (attribute and defect) should be delivered in a database format capable of integration into industry standard GIS systems. At a minimum, a mapping grade location for manholes shall be provided. Digital videos and photographs should be linked in the database to the manholes inspected.

Lift Station Inspection

Basic procedures for conducting lift station inspections are addressed in the 1989 Manual on Pages 4-11 to 4-18. Note that in case a **satellite entity** wishes to use a lift station as a flow monitoring point, the lift station should be calibrated first. This is performed using a force main pressure meter or by conducting a fill and draw calibration of the wet well, which includes timed calibration of the pump station discharge against wet well level. Data collected from lift station inspections (attribute and defect) should be delivered in a database format capable of integration into industry standard GIS systems. At a minimum, a mapping grade location and address linking, if applicable, for lift station locations shall be provided. Digital videos and photographs should be linked in the database to the inspection record.

Smoke Testing

Smoke testing is a relatively inexpensive way to identify inflow sources by introducing smoke into a sanitary manhole and observing points where smoke escapes to the atmosphere. Smoke testing is required under the Short Term IICP to identify downspouts that are illegally connected to the **sanitary sewer**, as well as direct and indirect cross-connections. Basic procedures for conducting smoke testing are addressed in the 1989 Manual on pages 4-31 to 4-35.

In addition to procedures addressed in the 1989 Manual, **sanitary sewer** smoke testing must be compliant with the NASSCO Performance Specification Guidelines for Sanitary Sewer Smoke

Testing - December, 2010 - including the use of NASSCO inspection header and defect codes. In the case of any conflict in procedures between the two standards, the NASSCO standard will govern. Due to the prevalence of clay soils and significant soil moisture typical in the Northeastern Illinois area, as well as the frequency of indirect cross-connections between **storm sewer**/storm ditches and the **sanitary sewer** system, smoke testing programs should include the following provisions:

- Smoke Blower Configuration
  In order to ensure that smoke is "driven" through soil seams and reaches the surface for identification of indirect cross-connections between **storm sewer**/storm ditches and the **sanitary sewer** as well as for the identification of main line and service lateral defects, dual smoke blowers must be used. One blower shall be placed at the upstream manhole and the other at the downstream manhole. It is not necessary to install blowers in adjacent manholes that are less than 400 linear feet apart. In such cases, one blower can be installed in the next manhole along the sewer. The dual blower configuration is shown in Figure 8.8.
- Identification of Suspect Sources
  As required in the NASSCO Performance Specification Guidelines for Sanitary Sewer Smoke Testing Section 3.03.A.4, suspect sources (sources that due to their nature may be connected to the **sanitary sewer**) should be recorded when vent stacks do not exhibit smoke. In addition, downspouts piped underground, driveway drains and area drains that are observed without any exiting smoke should be recorded for possible follow-up dye water testing, regardless of whether vent stacks did or did not exhibit smoke. Suspect sources like downspouts, area drains and driveway drains that are connected to the **sanitary sewer** may not exhibit smoke during smoke testing for one of two reasons:
  1. The main sewer that they are connected to has a blockage which limits smoke from getting to the source (ie. no vent smoke on homes), or
  2. The downspout, area drain or driveway drain itself is trapped or discharges to a clogged or partially blocked service lateral.

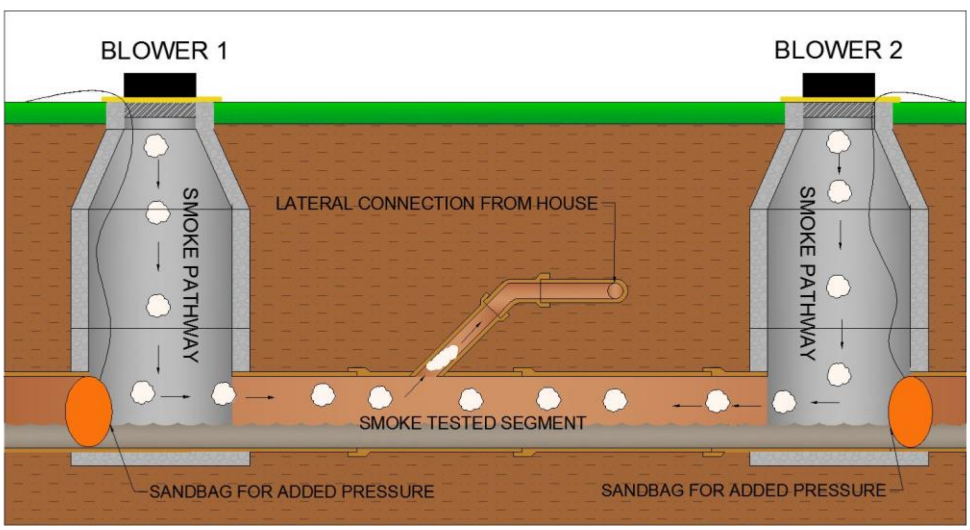

Figure 8.8. Dual-Blower Smoke Testing Process

Defect data collected from smoke testing should be delivered in a database format capable of integration into industry standard GIS systems. A mapping grade location for smoke observations shall be provided. Digital videos and photographs should be linked in the database to the smoke observations recorded.

Smoke testing will identify I/I sources on private property. The IICP requires disconnection of direct and indirect cross-connections within one year of identification. Other I/I sources will likely be identified during smoke testing, such as driveway drains, area drains, and window well drains. Although **satellite entities** are urged to take action to have such I/I sources disconnected promptly, the IICP requires that **satellite entities** keep records of the location and nature of such sources. The **satellite entities' PSP** will address whether and how such I/I sources are to be managed.

Dye Water Testing

Dye water testing will need to be performed at locations where smoke testing does not conclusively identify whether a potential inflow source is connected to the **sanitary sewer**, or where confirmation of a possible connection identified through smoke testing is needed. This method of testing is useful in confirming the presence of both direct inflow sources and indirect I/I sources. Dye water testing with plugging should be used for identifying cross-connections with **storm sewer**/storm ditches (with and without television inspection). Dye water testing without plugging should be used for confirming whether private sources (including downspouts piped underground, driveway drains and area drains) are connected to the **sanitary sewer**.

Basic procedures for conducting dye testing are addressed in 1989 Manual on pages 4-29 to 4-31. In addition to the provisions of the 1989 Manual, the typical nature of the I/I defects within the **District satellite entities** also requires that both depth of flow and velocity in the **sanitary sewer** should be measured before starting the dye water testing setup and again after dye transfers to the **sanitary sewer**. This allows for a quantification of the magnitude of peak flow from the cross-connection.

Under the IICP Short Term Requirements, direct and indirect cross-connections, directly connected downspouts, and broken or missing cleanout caps must be rectified. Dye water testing is an effective method for confirming these sources, if smoke testing alone does not. It is also effective at confirming other private sector I/I sources such as directly connected area drains, driveway drains and window well drains. While **satellite entities** are urged to identify and address as many of these I/I sources as possible during the Short Term Requirements, they are not obligated to do so until the **LTOMP** begins. Should such I/I sources be found during the Short Term Requirements, **satellite entities** must keep a record of the location and nature of the sources so that they can be addressed under the **PSP**.

Defect data collected from dyed water testing should be delivered in a database format capable of integration into industry standard GIS systems. A mapping grade location for defect observations shall be provided. Digital audio, videos, and photographs should be linked in the database to the defect observations recorded.

Property Inspection

Property inspections consist of entering onto private property and inspecting for any connections that contribute **stormwater** to the **sanitary sewer** collection system. Internal inspections involve entering the resident's home while external inspections involve checking the exterior parts of the **building** and yard(s). Typically, when inside the residence, inspectors are looking for storm or combination sump pumps discharging into the **sanitary sewer**, or a diverter setup where the homeowner can control the discharge location of the storm sump. The following are descriptions of the three common types of sump pumps and a diverter valve:

- **Sanitary Sump:** A sanitary sump collects sanitary wastewater from within a **building** and pumps it to the **sanitary sewer**.
- **Storm Sump:** A storm sump collects **groundwater** drainage from footing drains and routes it to a **storm sewer** or to the outside **building** yard. The correct configuration of storm and sanitary sumps and discharge piping is shown in Figure 8.9. Storm sumps that are improperly connected to the sanitary sewer, as shown in Figure 8.10, can be significant sources of inflow.

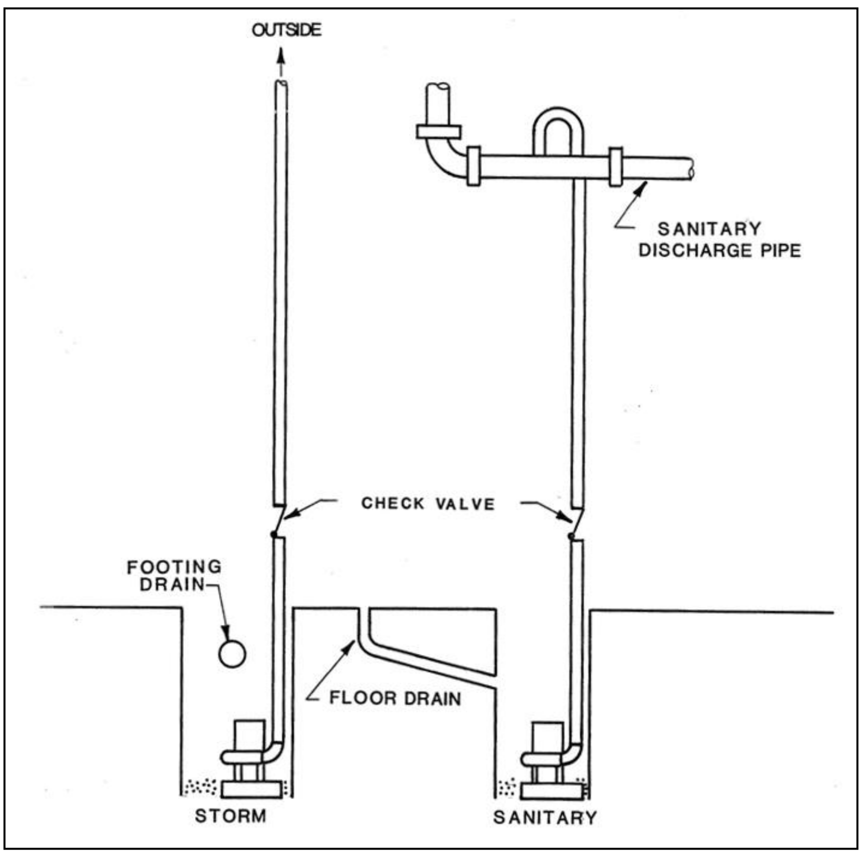

Figure 8.9. Separate Storm and Sanitary Sumps with Separate Discharge Piping (Compliant Condition)

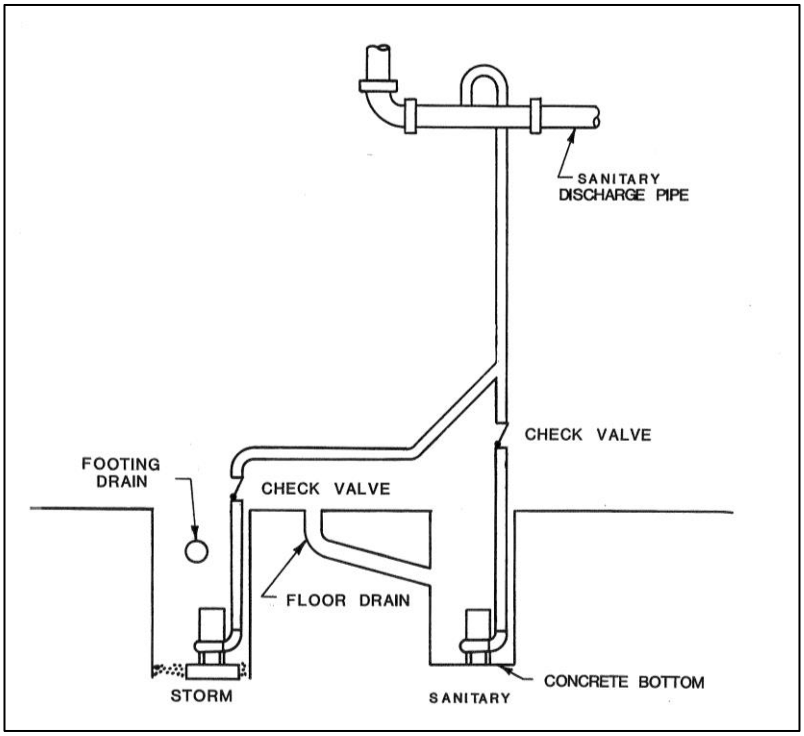

Figure 8.10. Storm Sump Connected to Sanitary Sewer

- **Combination Sump:** A combination sump collects both sanitary waste and **groundwater** drainage and is routed to the **sanitary sewer**. Figure 8.11 illustrates this configuration.

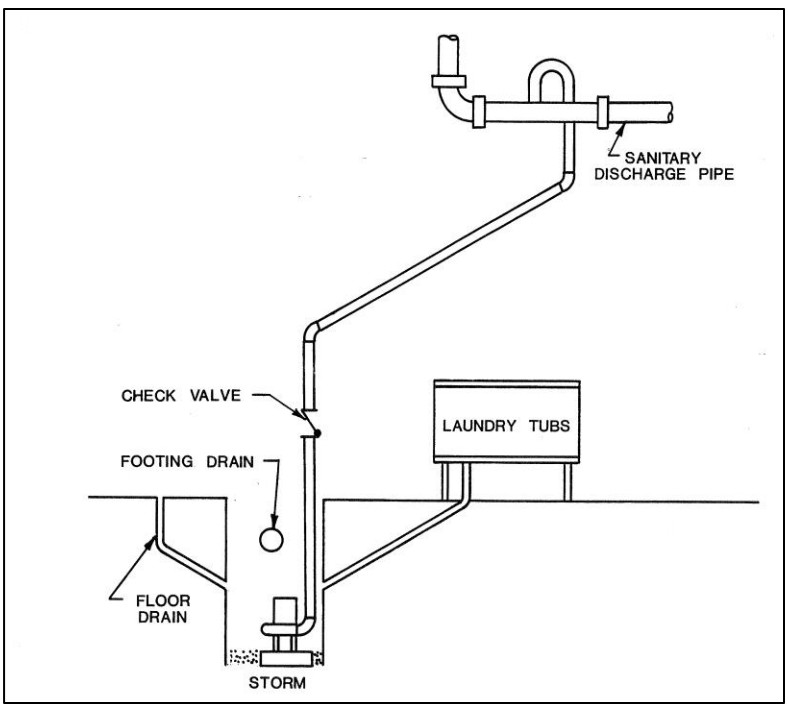

Figure 8.11. Combination Sump Pump

- **Diverter Valve:** A diverter valve is a valve on a storm sump that allows routing the storm sump discharge to either the **sanitary sewer** or to the outside yard. Figure 8.12 shows a storm pump installation using a diverter valve.

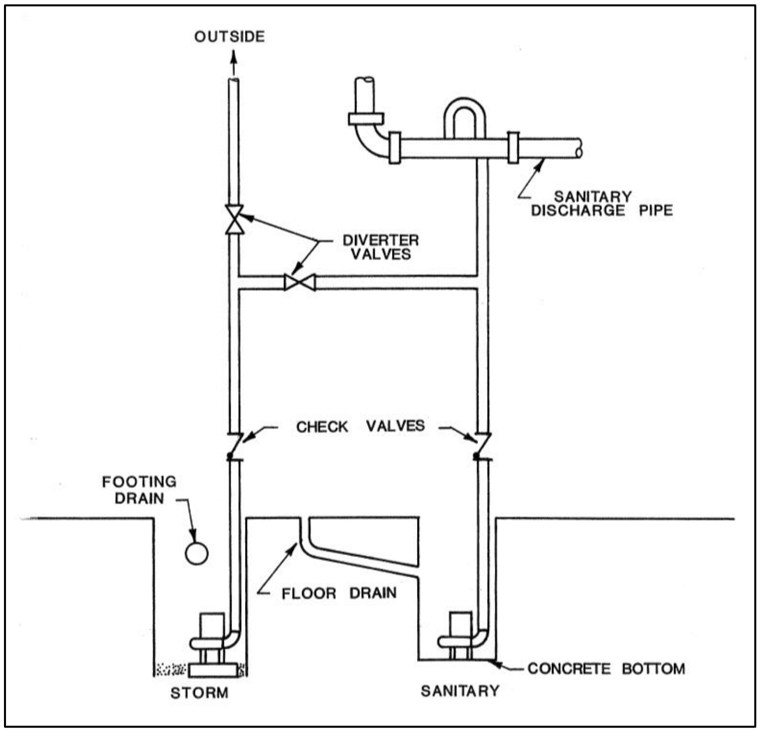

Figure 8.12. Storm Sump with Diverter Valve

Under the Short Term Requirements, **satellite entities** are not required to conduct internal **building** inspections. However, **satellite entities** may need to enter onto private property to conduct dye water testing where smoke testing does not conclusively identify whether a downspout discharging underground, or whether a cleanout with a damaged or missing cap does not release smoke during smoke testing. **Satellite entities** will also have to enter onto private properties to verify corrective work to address illegally connected downspouts and uncapped cleanouts, in order to fulfill the Short Term Requirements. Internal/external property inspections will be required as part of the **PSP** and **LTOMP**, as described later in this chapter. Basic procedures for conducting internal/external **building** inspections are addressed in the 1989 Manual on pages 4-21 to 4-23.

In addition to procedures in this manual, the **District** recommends that internal/external **building** inspection also include dye testing to determine whether storm sumps, combination pumps, and/or unsealed sumps discharge to the **sanitary sewer** or to some other location. This dye testing would be used only when the discharge location of the sump pump cannot be determined visually.

Data collected from private property inspections (attribute and defect) should be delivered in a database format capable of integration into industry standard GIS systems. At a minimum, data collected shall be linked to an address and a mapping grade location. Digital videos and photographs should be linked in the database to the inspection record.

Additional Condition Assessment Methods

Additional condition assessment methods such as flow monitoring, electro scanning, and blockage detection using acoustic testing are described in §805. Although these techniques are not required by the **District**, **satellite entities** are encouraged to use them where appropriate to identify portions of the **sanitary sewer** system requiring more detailed inspection, **maintenance** and/or rehabilitation.

High Priority Deficiencies

The goals of conducting a condition assessment of high risk **sanitary sewers** under the Short Term Requirements are:

- To identify High Priority Deficiencies, and
- To identify rehabilitation needs which form the basis of a Capital Improvement Plan (CIP).

High Priority Deficiencies are defects that have a low cost of removal to I/I flow rate ratio or that have a high likelihood of causing sewer collapse or blockages if not rehabilitated. All High Priority Deficiencies must be addressed and corrected as quickly as possible. The **District** requires that direct and indirect cross-connections identified during a conditions assessment of the high risk sewers be disconnected within one year of identification. This includes downspouts that are directly connected to the **sanitary sewer** or poorly disconnected from the **sanitary sewer**. In some cases, downspouts that were disconnected by plugging of the downspout lead line at grade with hydraulic cement have deteriorated over time to allow roof water to re-enter the **sanitary sewer**. The **District** requires repair of missing or broken lateral cleanout caps within one year of identification. For those High Priority Deficiencies that cannot be immediately addressed, a CIP must be prepared to correct them. Work on High Priority Deficiencies in the CIP must begin within three years of identification of the High Priority Deficiencies.

In order to ensure uniformity in defect coding across all **satellite entities**, they must be in compliance with the NASSCO defect identification and l coding system for **sanitary sewers**, manholes and service laterals. . NASSCO's defect codes are assigned a grade from 1 to 5 using the PACP® Code Matrix (provided in NASSCO's Certification Program documentation) and in Appendix D. Grades are assigned based on the significance of the defect, extent of damage, percentage of flow capacity restriction or the amount of wall loss due to deterioration. Detects fall within one of two categories—either structural defects or O&M defects, with 5 indicating the most significant defects.

A High Priority Deficiency is defined as NASSCO condition Grade 4 or 5 and all illegal connections. However, for the purpose of the IICP, high-cost removal of illegal sources including driveway drains, foundation drains and window well drains can be addressed under a long term disconnection program that is part of a **satellite entity's PSP**.

High Priority Public Main Line Sanitary Sewer Defects

High Priority Deficiencies include structural and/or operation and **maintenance** defects that allow significant I/I and defects that could result in sewer collapse or blockage that may lead to dry and/or wet weather **SSOs** or **BBs**.

The following tables summarize current NASSCO defect coding and grading of High Priority Deficiencies in **sanitary sewers.** The current NASSCO Manual should always be referenced for the latest codes and grades:

Table 8-1. Structural High Priority Deficiency Grades

Structural	Grade
Crack Hinge	4-5 (depends on location)
Fracture Multiple	4
Fracture Hinge	4-5 (depends on location)
Broken	5
Collapse	5
Deformed	4-5 (depends on severity of deformation)
Hole	4-5
Surface Aggregate Missing	4
Reinforcement Visible	5
Reinforcement Corroded	5
Missing Wall	5
Brick Work Missing	4
Dropped Invert (brick)	5

Table 8-2. O&M High Priority Deficiency Grades

O&M	Grade
Deposits (all) 20-30%	4
Deposits (all) > 30%	5
Root Ball Barrel	5
Root Ball Lateral	4
Root Ball Connection	4
Infiltration Runner	4
Infiltration Gusher	5
Obstacles/Obstructions (all) 20-30%	4
Obstacles/Obstructions (all) > 30%	5

High Priority Manhole Defects

High Priority Manhole Defects include structural and/or O&M defects that allow significant I/I, in addition to defects that could result in manhole collapse or blockage that could lead to dry and/or wet weather **SSOs** or **BBs**. Manhole inspections are performed in accordance with the NASSCO Level 1 and Level 2 inspection criteria. Level 1 inspection is performed to evaluate the general condition of the structure and to determine if a Level 2 inspection is needed. A Level 2 inspection is to gather detailed information to fully document all existing defects.

The following tables summarize current NASSCO defect coding and grading of High Priority Manhole defects for Level 1 and Level 2 inspections. The current NASSCO Manual should always be referenced for the latest codes and grades:

Table 8-3. Level 1 Defect Codes (General Condition)

Level 1	Condition
Cover Type	Vented
Cover Condition	Cracked, Broken, or Missing
Frame Condition	Cracked, Broken, or Missing
Frame Offset Distance	> 3-inches
Frame Seal Inflow	IG, IR, or ID
Chimney I/I	IG, IR, or ID
Additional Component Information	Note significant structural or I/I observations

Table 8-4. Level 2 Defect Grades (Detailed Inspection - Structural)

Level 2 Structural	Grade
Fracture Multiple	4
Broken	5
Collapse	5
Deformed	4-5 (depends on severity of deformation)
Surface Aggregate Missing	4
Reinforcement Visible	5
Reinforcement Corroded	5
Missing Wall	5
Brick Work Missing	4

Table 8-5. Level 2 Defect Grades (Detailed Inspection - O&M)

Level 2 O&M	Grade
Root Ball Barrel	5
Root Ball Lateral	4
Root Ball Connection	4
Infiltration Runner	4
Infiltration Gusher	5
Obstacles/Obstructions (all) 20-30%	4
Obstacles/Obstructions (all) > 30%	5
Root Ball Barrel	5
Root Ball Lateral	4

High Priority Cross-Connections

Cross-connections between **sanitary sewers** and **storm sewer**s/storm ditches can be large contributors of I/I flows into a **sanitary sewer** system. Cross-connections are first identified during a smoke testing program. Smoke reaching the surface in a storm ditch or exiting a **storm sewer** inlet and/or manhole is typically followed by dye water flooding of the **storm sewer**/storm ditch to confirm the transfer of dyed water from the **storm sewer**/storm ditch to the **sanitary sewer**. The final step involves the television inspection of the **sanitary sewer** concurrent with dyed water flooding to pinpoint the exact location(s) of the defect(s) in the **sanitary sewer** that allow **stormwater** to enter the **sanitary sewer**. In some cases the entry point is on the **sanitary sewer** service lateral, not the main line sewer. Removal of the cross-connection(s) will therefore require rehabilitation of the service lateral. In most cases, the peak rate of wet weather flow from **sanitary sewer**/**storm sewer** cross-connections results in them being classified as High Priority Deficiencies. Direct and indirect cross-connections found during the condition assessment performed as part of the Short Term Requirements must be repaired within one year of identification. Direct cross-connections include locations where the **storm sewer** or storm inlet/catch basin is directly piped into the **sanitary sewer**. These direct connections are unusual. Indirect cross-connections are locations where **stormwater** flows from a **storm sewer** pipe or storm ditch down into the **sanitary sewer** via a soil seam, as illustrated in Figure 8.13. The most common type of indirect cross-connection involves **stormwater** from a storm ditch or **storm sewer** flowing down through an open soil seam and into a service lateral located directly under the **storm sewer** or storm ditch. Many **storm sewers** were constructed without pipe joint materials, or the pipe joints have deteriorated enough over time to permit **stormwater** to flow out of the **storm sewer**. The magnitude of flow from an indirect cross-connection can be significant, in some cases approaching that of a direct cross-connection.

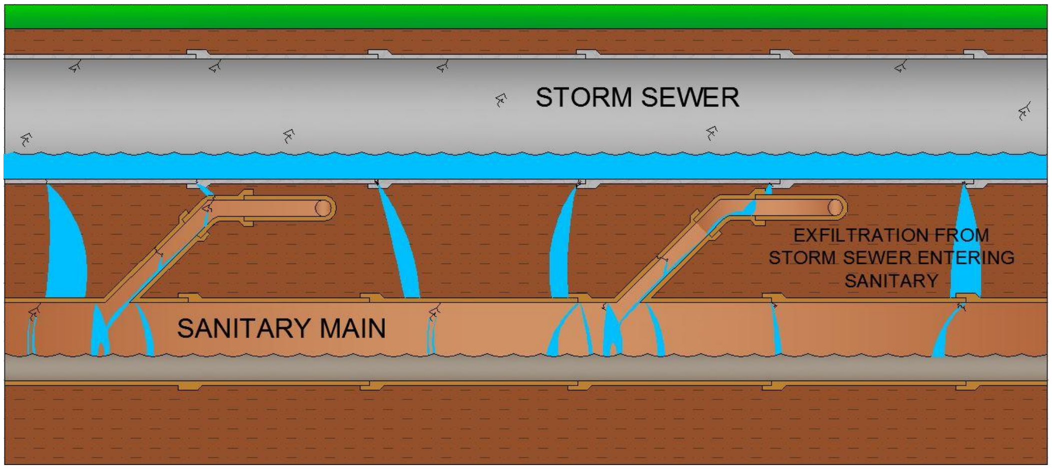

Figure 8.13. Storm-to-Sanitary Sewer Cross-Connection

High Priority Private Sector Deficiencies

All connections that allow **groundwater** or **stormwater** into the **sanitary sewer** are illegal and are considered High Priority Deficiencies. However, the removal, disconnection and/or rehabilitation of high-cost I/I sources (e.g., service lateral, foundation drains, driveway drains, area drains and window well drains) may be addressed under a **LTOMP**.

Low-cost High Priority Deficiencies corrections include: downspout disconnections (Figure 8.14), replacing missing and/or damaged cleanout caps/covers and addressing poorly disconnected downspout drains that act as area drains. These High Priority Deficiencies must be addressed within one year of identification.

Downspout connections and open cleanouts can be identified through **sanitary sewer** smoke testing programs and/or visual inspections. In some cases, downspouts that discharge underground may not smoke, and will require follow-up dye testing to confirm whether the downspout is connected to the **sanitary sewer**. In other cases, downspouts that were disconnected from the **sanitary sewer** by plugging the lead line from the downspout will be identified during a smoke testing program and may require follow-up due to deterioration of the plug over time.

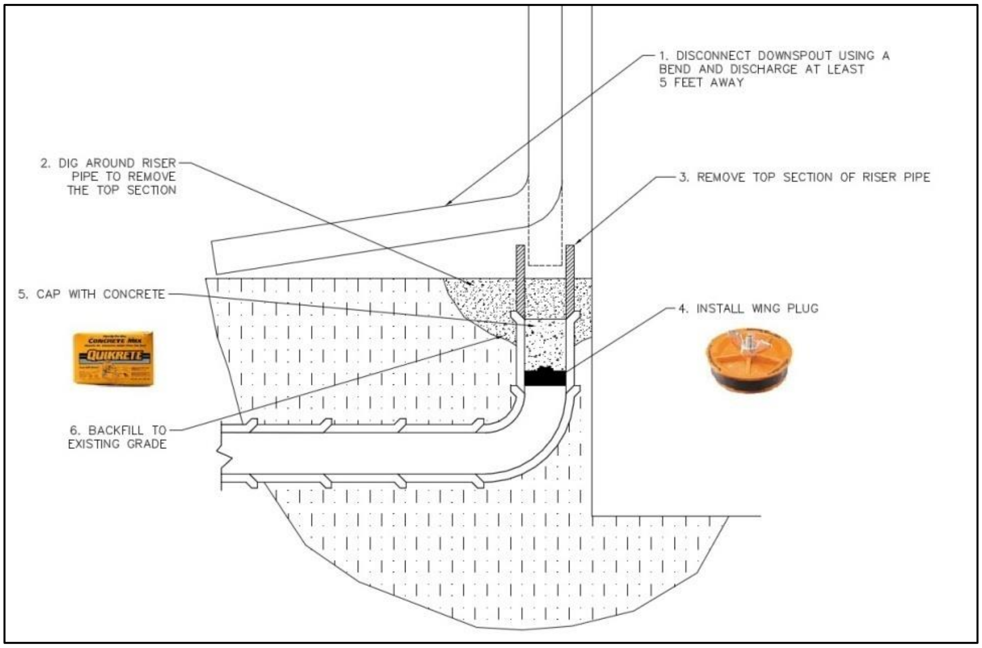

Figure 8.14. Typical Remediation of Connected Downspouts

Sewer System Rehabilitation

Sanitary sewer and manhole rehabilitation must take place for High Priority Deficiencies found during the condition assessment. Additionally, any connected downspouts, poorly disconnected downspouts, and cleanouts that are missing caps/covers will be required to be disconnected and/or repaired. These types of deficiencies can contribute large amounts of I/I into the **sanitary sewer** system. **Satellite entities** may need to work with property owners to correct these deficiencies; however, low-cost defects must be corrected within one year of identification.

Satellite entities must complete a *Status of High Priority Deficiencies Form* for tracking the status of High Priority Deficiencies that are not fixed by the end of the year in which they are identified. This form must show an identification number for each High Priority Deficiency, the date identified, the anticipated correction date, actual correction date, the means of correction and the **District** permit number under which the correction was performed. If any deficiencies are to be addressed by in-house staff, this should be noted on the form. This form is to be updated annually and submitted to the **District** with the Short Term Requirements Annual Summary Report. High Priority Deficiencies can be removed from the form only after the deficiencies have been corrected and the Actual Correction Date has been reported to the **District** as part of the annual report. An example of selected entries in the *Status of High Priority Deficiencies Form* is shown in Figure 8.15.

As indicated earlier, credit may be given for condition assessments of high priority sewers performed by a **satellite entity** in the five year period preceding the effective date of the IICP. If high priority deficiencies have been identified during these pre-IICP condition assessments but have not been addressed, these must be included on the *Status of High Priority Deficiencies Form*.

For High Priority Deficiencies that cannot be corrected and/or addressed in the short term, the **satellite entity** must prepare a CIP. The CIP will detail the plan and schedule for the long term correction of all identified High Priority Deficiencies. Information to be included in the CIP includes the name of capital projects, description of project areas, project cost, project funding source, anticipated project start date, duration, and project completion date. A sample CIP is included in Appendix D. The CIP should identify publicly funded projects to address items on the *Status of High Priority Deficiencies Form*. The CIP should not include **maintenance** work performed by in-house staff. The CIP must be submitted as part of the Annual Report and should be updated to indicate items that have been corrected and to include newly identified High Priority Deficiencies. Rehabilitation work to correct High Priority Deficiencies must begin within three years of identification of the deficiencies. One of the means by which the **District** will monitor progress under the IICP will be through its permitting process. **Satellite entities** are reminded that a **District** permit will be required for **sanitary sewer** system repair and rehabilitation work. The scope of work to be performed under a project will determine whether a **Watershed Management Permit** or a Notification and Request for Inspection will be required. **Satellite entities** are encouraged to contact the **District** for assistance in determining which type of permit is appropriate.

ONE YEAR DEFICIENCIES						
Deficiency ID	High Priority Deficiency Type	Date Identified	Anticipated Correction Date	Actual Correction Date(1)	Means of Correction	District Permit Number(2)
P-0016	Directly connected downspout	6/16/15	4/17/16	Future	Property owner to disconnect and install rain barrel	Not required
P-0103	Missing cleanout cap	6/20/15	4/1/16	Future	Property owner to replace	Not required
0984	Storm sewer connected to sanitary at Lake and Wagner	7/18/15	7/18/16	Future	Part of FY2016 Sewer Cleaning/CIPP lining contract	15-5133
0735	Stormwater in pond at Pleasant Park infiltrates into 8" san. sewer	7/20/15	7/20/16	Future	Line sewer as part of FY2016 Sewer Cleaning/CIPP lining contract	15-5133
THREE YEAR DEFICIENCIES						
Deficiency ID	**High Priority Deficiency Type**	**Date Identified**	**Anticipated Correction Date**	**Actual Correction Date(1)**	**Means of Correction**	**District Permit Number(2)**
1234	Main line Fracture Multiple	5/1/2015	10/1/2016	Future	FY2016 Sewer Cleaning/CIPP lining contract	15-5133
1956	Deformed sewer main line, 20'	5/15/2015	10/15/2017	Future	Wagner Road Sewer and Water Main Replacement Project	No permit yet
2668	Main line Infiltration Gusher	6/1/2015	10/1/2017	Future	FY2017 Sewer Cleaning/CIPP lining contract	No permit yet
2969	Visible reinforcement in manhole	6/23/2015	10/1/2016	Future	FY2016 Sewer Cleaning/CIPP contract	15-5133
3143	Manhole chimney I/I - IG	6/30/2015	10/15/2016	Future	Smith Avenue Road Repair Project	No permit yet
4217	Infiltration runner in manhole	5/3/2015	6/1/2016	Future	Manhole Repair contract	16-5003

(1) Entries in this column will all be "Future" in the first Annual Report, but will contain actual completion dates in subsequent reports as repair work is performed.

(2) Enter the permit number once it is issued.

Figure 8.15. Sample Entries into Status of High Priority Deficiencies Form

Development of the Private Sector Program

Each **satellite entity** is required to develop and submit to the **District** for approval a **Private Sector Program** (**PSP**) that will detail the means and methods for on-going internal and external I/I source identification and the removal of these sources. The goal of the **PSP** is to reduce **BBs** and **SSOs** by removing I/I sources. **Satellite entities** that do not already have inspection ordinances in place will need to enact ordinances granting them authority to conduct inspections and take enforcement actions for **PSP** compliance. A procedure to notify owners of the inspection, and to obtain consent must be established. The procedure must detail steps to be taken in the event consent is not given, such as fines, denial of service, obtaining a warrant and litigation, as well as procedures for handling non-compliance. The **PSP** will need to address how private sector I/I sources identified during the Short Term IICP inspections will be addressed. The **PSP** should be adequately funded and staffed with qualified personnel to implement the program. See Appendix D for a sample **PSP**.

The following items further describe what is required for a PSP:

1. Staff / Training / Authority

   Adequate and appropriately trained/qualified staff and/or contractors will be provided to implement all necessary components of the **PSP**. An organizational structure should be established that clearly defines responsibilities and authority for all staff. Staff should be periodically trained in their respective responsibilities including how to conduct internal and external property inspections, and how to document findings consistently. Staff must be equipped with necessary and proper equipment, tools and materials (smoke/dye/flood testing, camera, etc.) to perform the work required under the **PSP**. As part of the **PSP**, **satellite entities** must list the staff job titles that will have responsibility for implementation of the **PSP** and an estimated number of hours per month that will be allocated to work on the **PSP**.

2. Local Authority

   Satellite entities will be required to enact ordinances, resolutions, bylaws, and/or access agreements that will provide authority to gain access to properties for I/I source inspection and identification, and to enforce **PSP** compliance, if they do not currently have such legal measures in place. Such agreements must provide **satellite entities** with authority to conduct exterior and interior inspections of private property. **Satellite entities** should have legal counsel to advise them for any proceedings toward owners that refuse access for inspection. As part of the **PSP**, **satellite entities** must provide a copy of their ordinances, resolutions, bylaws, and/or access agreements that give them the authority to conduct inspections for I/I sources.

   Examples of Inspection and Enforcement Ordinances are posted on the **District's** website at: https://www.mwrd.org/irj/portal/anonymous/Infiltration. Most of the examples are from **satellite entities** within the **District's** service area.

3. Inspection

   Satellite entities must develop a private property inspection program to address the disconnection of illegal private infiltration and inflow sources. In general, inspections are to be made in areas where private sector I/I appears to be a significant contribution of the overall I/I in a system. At a minimum, if a portion of the satellite system experiences **BBs** and/or **SSOs** during multiple wet weather events within one 12-month period and if the public sector **sanitary sewer** system has no unrehabilitated High Priority Deficiencies, then the **satellite entity** should conduct inspections of private properties in the impacted area, upstream areas, or any other areas that the **satellite entity** believes may be contributing to the **BBs** and **SSOs**. **Satellite entities** may include additional criteria for conducting private property inspections as part of their **PSPs**. A written description of the private property inspection program, including all inspection checklists, sample notice letters, door hangers, and documentation of non-compliance, must be submitted to the **District** as part of the **PSP**. Note that the inspection program should have clear procedures for notification to property owners, obtaining consent for inspections, and procedures for properties where consent is not given, such as fines, denial of service, obtaining a warrant and litigation. **Satellite entities** are urged to consult an attorney when developing inspection procedures to ensure constitutional protections of private property rights are not violated.

   Inspections will be conducted to locate and identify private property internal and external I/I sources and to document all sewer connections. **Satellite entities** may wish to use the authority provided by sewer use ordinances and private property inspections for **building** permits to ensure that sanitary and **stormwater** utilities on private property are properly connected as to prevent the allowance of I/I sources connected to **sanitary sewers**. Implementation of the program can be coupled with water meter readings or replacements, water heater, furnace, or air conditioner replacement, roadway reconstruction or resurfacing projects, and etc. A list of I/I sources should be created and added to an inspection checklist. A sample checklist is included in Appendix D. Ideally, all properties will be inspected on a 10-15 year cycle with priority given to areas known to have **SSOs** and **BBs** and areas upstream. In addition, more frequent inspections may be necessary depending upon the system's condition (e.g., sewer age and material, areas that connect I/I sources to the sewer system during original construction, history of violations, **SSOs** and **BBs**, and etc.).

   Internal **building** inspections typically include visual inspections of sump pumps and sump pump discharge piping, and may include insertion of dyed water into sump pits if the discharge location is indeterminate by visual inspection alone.

   External home inspections may also be periodically employed to identify potential private property I/I sources visible from outside the property, such as downspouts, area drains, or defective cleanout caps. Visual inspections can identify I/I sources from cleanouts and potential I/I sources from area drains and downspouts that discharge underground. Smoke testing is the most effective starting point for identifying external private property sources.

However, dye testing is often required to trace and confirm the discharge locations of area drains and downspouts that terminate underground.

An inspection of the lateral is recommended when other I/I sources have been ruled out. The following tests should be utilized: visual, smoke testing, dye testing and CCTV. Inspection of laterals should be conducted according to NASSCO Lateral Assessment and Certification Program (LACP®) standards, and diligence should be taken to cross-reference LACP® inspection data with PACP® data from inspections of connecting public sewer mains to properly establish where connections are located.

A hierarchy of various sewer connection and/or condition status should be established and documented upon inspection. Examples of status are: compliance, partial compliance (e.g., sump pump connected, downspout disconnection), and non-compliance. Special care should be taken when classifying connections for non-compliance. For example, both a downspout and a foundation drain tied into the **sanitary sewer** are illegal connections. However, disconnection of the downspout(s) is relatively easy and must be completed in the short term and should be categorized as non-compliant, whereas, the foundation drain connection is generally a long term correction item and may not trigger an immediate non-compliance notification. The **District** considers footing drains, driveway drains, and leaking laterals to be high-flow, high-cost private sector I/I sources. Although **satellite entities** are encouraged to work with property owners to have these high-flow, high-cost private sector I/I sources addressed quickly, the **District** recognizes that the cost of such repairs may make this difficult. Therefore, **satellite entities** are required to establish a long term program under which such high-flow, high-cost private sector I/I sources may be addressed.

4. Non-Compliance Correction

   A notification and correction procedure must be established to notify, assist, and educate owners of non-compliance. The procedure should include how the owner is notified, a schedule to correct the non-compliance, and verification through re-inspection.

   The notification must include a letter to the property owner describing the non-compliant condition, stating the date by which the condition must be corrected, and describing legal actions that will be taken by the **satellite entity** if the owner does not correct the condition. The notification may also include educational material on the type of disconnection/rehabilitation required, a list of bonded/insured contractors in the area capable of performing the work, information regarding funding assistance provided by the **satellite entity** and/or regional agency.

5. Long Term Program to Address High-Cost I/I Sources

   As indicated above, the **District** recognizes that many sources of private sector I/I are costly to remove. Satellite system owners must establish a program that documents which properties have high-cost, high-flow I/I sources, which includes footing drains, driveway drains, area drains, and leaking laterals. Information on such sources gathered through municipal records and/or inspections must be documented and stored in perpetuity. The long term program must establish means by which such I/I sources may be removed. This section of the **PSP** must address identification and correction of private sector I/I sources identified during the first five years of the IICP. Establishing and promoting cost-sharing programs for correcting such sources, and enacting ordinances requiring removal of such sources in conjunction with tear-downs or major home improvements are examples of components of a long term program. A sample long term program is included with the **PSP** example in Appendix D.

Ultimately, **satellite entities** are to use discretion to determine the extent to which removal of high-flow, high-cost private I/I sources must occur, in conjunction with any other sewer system improvements, to achieve the IICP goals of reducing **BBs** and **SSOs**.

6. Enforcement

   A hierarchy of enforcement actions should be established when an owner fails to comply with a notification of non-compliance. Enforcement action(s) must be established through the enacted ordinance of the **satellite entity**. The hierarchy should be structured such that an escalation of penalties occurs. Examples include fines, denial of service and litigation.

7. Funding

   The **PSP** must be appropriately funded every year. All costs should be tracked to develop subsequent **PSP** budgets such that any future rate increases are justified if they are needed. In general, the **PSP** will be funded as part of the **satellite entity's sanitary sewer maintenance** program. As part of the **PSP**, **satellite entities** must identify the amount of money they intend to allocate towards the **PSP** each year, in addition to identifying the source of the funding.

8. Public Information

   Educational/outreach programs should be created and promoted to introduce the general public, new property owners, realtors and area plumbers to the **USEPA**, state and local regulations requiring I/I control and the **PSP**. Such programs should also explain the public health, environmental, regulatory and other benefits of I/I reduction efforts, and inform the public of their responsibilities related to the I/I problem. Public outreach should include information regarding basic I/I education, how the individual can help with reducing I/I, and information regarding new ordinance and inspection requirements. Brochures, village publications, websites, mailings, inserts in water bills, and emails can convey this information. As part of the **PSP**, **satellite entities** must describe their public information program and must attach any brochures or publications they distribute about private sector I/I control. Such materials must be reviewed every ten years and updated if necessary.

Each satellite system owner must submit a **PSP** to the **District** within five years of the effective date of the IICP. Each satellite system owner must report on the progress of development of its

PSP on the Short Term Requirements Annual Summary Report. Examples of activities to report during the development of the **PSP** include:

- Drafting language for inspection and required disconnection ordinances;
- Determining requirements for private sector inflow source removal cost-sharing programs(1);
- Developing a brochure about private sector inflow source removal cost-sharing programs including plumbing;
- Details for acceptable disconnection materials and methods(1);
- Establishing variance procedures for unique individual disconnections related to unreasonable cost or lack of a feasible discharge location;
- Developing rules and application forms for private sector inflow source removal cost-sharing programs(1);
- Adopting ordinances for inspection programs(2);
- Adopting ordinances for cost-sharing programs(1);
- Developing private property inspection procedures;
- Establishing rules and ordinance language related to overhead sewer installation;
- Establishing rules and ordinance language for periodic re-inspection of homes;
- Establishing rules and application forms for backflow prevention devices, with and without pump-over capability(1) (2);
- Establishing policy and ordinance language for elimination of all clear water sources in conjunction with a "tear down" or major renovation(1);
- Establishing policy and ordinance for inspection of homes for compliance as part of all property transfers(1) (2);
- Posting all relevant documents and forms on the satellite system website and/or newsletters;
- Training staff on how to conduct inspection of private property; and
- Entering into agreements with consultants to conduct inspections of private property.

(1) This is recommended, but not mandatory.
(2) Please visit the **District's** website to see examples of similar programs administered by local satellite sewer system owners.

Reporting of Sanitary Sewer Overflows and Basement Backups

The **District** will use information about **SSOs** and **BBs** to view trends over time within individual **satellite entities**. Implementation of an effective I/I control program and sewer **maintenance** and rehabilitation program within a **satellite entity's** sewer system should result in fewer **SSOs** and **BBs** during low to moderate recurrence interval wet weather events over time. Therefore, under the IICP, **satellite entities** are required to keep records on all **SSOs** and **BBs** that occur within their system. A *Sanitary Sewer Overflow and/or Basement Backup Satellite Entity Internal Summary Form* must be completed for every **SSO** or **BB** that occurs within a **satellite entity's sanitary sewer** system. These forms do not need to be submitted to the **District** unless the **District** requests them.

Information about **SSO**s and **BB**s within the **sanitary sewer** system must be provided where indicated on the Short Term Requirements Annual Summary Report and on the **LTOMP** Annual Report. In general, causes of all **SSOs** and **BBs** should be determined and these causes should be corrected to prevent future **SSOs** and **BBs**.

Auditing

The **District** reserves the right to audit any **satellite entity** following submittal of the Short Term Requirements Annual Summary Report. The purpose of such audits is to:

- Review condition assessment and inspection documentation;
- Verify the quantity of assessment work performed within reporting years;
- Verify that assessments were conducted according to NASSCO standards, or approved equivalent standards;
- Verify that repairs of High Priority Deficiencies have been performed;
- Review records of private property inspection program;
- Review list of properties with high-flow, high-cost I/I sources; and
- Verify that detailed records on **SSOs** and **BBs** are kept.

LONG TERM O&M PROGRAM (§805)

The **sanitary sewer** system is designed to remove wastewater from homes and other **buildings** and convey it to the **District's** water reclamation plants (WRPs). A **sanitary sewer** system that is not properly designed, managed, operated and maintained can pose potential risks to the environment and public health. These risks arise through system failures or when I/I flow enters the **sanitary sewer** system through defects and/or deficiencies. I/I flows reduce sewer system capacity which results in **SSOs** and **BBs**. Therefore, a **LTOMP** is required for a successful I/I control program. The **LTOMP** shall be continually implemented by **satellite entities** to maintain **sanitary sewer** system capacity and performance, thereby reducing **SSOs** and **BBs**.

A major, often over-looked, portion of the **sanitary sewer** system is the private sewer system. The private sewer system can account for as much as 50% of the entire sewer system. Recent published studies have documented that up to 80% of I/I enters the sewer system through private sector sources. Therefore, in addition to the aforementioned **LTOMP**, a **PSP** is required to achieve meaningful I/I control and reduction. The **PSP** shall be continually implemented by all **satellite entities** to identify and remove internal and external I/I sources, thereby reducing **SSOs** and **BBs**.

The **LTOMP** and **PSP** should be adequately funded and staffed with qualified personnel to implement the program.

Requirements for the **LTOMP** and **PSP** are based in part on the **USEPA**'s Capacity, Management, Operation and Maintenance (CMOM) guidelines. CMOM is a flexible, dynamic framework for **sanitary sewer** system owners to identify and incorporate widely accepted wastewater industry practices to better manage, operate and maintain collection systems, investigate capacity-constrained areas, and respond to **SSO** events.

The CMOM program was developed in an attempt to establish a process and framework that would allow collection system owners and operators to:

1. Understand the components that the collection system is composed of, as well as understanding how the collection system performs.
2. Identify goals and objectives for managing a specific collection system.
3. Ensure that appropriate program components are in place, including administrative and **maintenance** functions, legal authorities, and design and performance standards.
4. Strive for adjustment of implementation activities to reflect changing conditions; including monitoring and measuring program implementation and making appropriate modifications, conducting necessary system evaluations, implementing a capacity assurance program, and conducting periodic program audits to evaluate implementation, identify deficiencies and to generate steps to respond to them.
5. Prepare for and respond to emergency events.
6. Communicate with interested parties on the implementation and performance of the CMOM program.

In 2001, **USEPA** proposed a rule under which CMOM programs would have been required of **sanitary sewer** system owners in their **NPDES** permits. This rule was never adopted at the federal level, however, some states have taken steps to implement CMOM programs through **NPDES** permits. For example, the IEPA has included special conditions in **NPDES** permits issued to the **District** in 2013, that require development of CMOM plans for the **District's** own collection facilities.

The **District's** website includes a link to **USEPA**'s Guide for Evaluating CMOM Programs. **Satellite entities** are encouraged to review this reference as they prepare their **LTOMP**. Several specific recommended practices aimed at reducing reactive **maintenance** and fostering more effective proactive **maintenance** programs are described in this document.

The following items describe what will be required for an LTOMP:

1. Sewer System Management

   Sewer System Management includes staffing, training of staff, standard operating procedures, and tracking of **maintenance** activities and complaints. Clearly defined procedures, management and training are required for effective O&M activities to reduce potential risks to the environment and public health.

   a. Staff, Training and Safety

Staffing with **satellite entity** personnel and/or subcontractors will be provided to implement necessary components of the **LTOMP**. **Satellite entities**' **LTOMPs** must establish an organizational structure that clearly defines responsibilities and authority for all personnel including operation and **maintenance** staff.

Staff should be periodically trained in their respective responsibilities. Training should be provided for the following: public relations and customer service, safety, sewer O&M activities, lift station O&M activities, **SSO**/**BB** emergency response, sewer inspection, repair, rehabilitation and replacement. **Satellite entities**' **LTOMPs** must include a description of the staff training program.

Internal communication procedures should be established to coordinate and/or advise staff of information regarding the implementation or performance of the **LTOMP**.

Staff must be provided with required safety equipment to perform the work required under the **LTOMP**, and safety procedures must be provided to staff in writing (including procedures, policies and training courses). Safety equipment must be maintained for the staff to perform daily activities and undertake any emergency repairs.

The purpose of a safety program is to define the principles under which the work is accomplished, to establish safe working procedures, and to establish and enforce specific regulations and procedures. The safety program should be in writing (including procedures, policies and training courses) and training shall be documented. Safety measures to be taken when developing or improving a sewer **maintenance** program are described in detail in Chapter 9 of the 1989 Manual.

Personnel involved in **sanitary sewer maintenance** activities need to be aware of the many safety risks inherent with **sanitary sewer** systems. Risks associated with explosive gases, oxygen depletion, toxic gases, pathogens, engulfment, falling objects, traffic control, tripping and falling all must be mitigated when preparing to enter a manhole or sewer. Completing a confined space entry permit and work plan prior to entering a manhole will help to ensure that participants are aware of all of the equipment they will need as well as insuring that they are aware of unique challenges to a particular task. All **sanitary sewer maintenance** crews shall have access to and training on the use of portable gas detectors, which produce visual and audible warnings when hazardous atmospheres are detected.

Satellite entities should have written lock-out and tag-out procedures and provide training on these procedures. The purpose of lock-out and tag-out protocols is to ensure that equipment cannot be operated while it is being serviced (such as a pump undergoing **maintenance**). Such procedures also protect people working in areas that could become unsafe for human occupation if the locked out equipment could be operated. Tags and locks should be placed on the equipment by all parties involved in operating the equipment, as well as by the parties who need the equipment locked, so that equipment cannot be restarted until all affected parties verify that it is safe to do so.

Training for new employees and routine refresher training for existing employees is essential to any effective safety program. **Satellite entities** should designate a staff member who is responsible for keeping track of when each employee received training on a particular topic, and when they must take a refresher course.

Safety training and programs should be in place for the following:

- Confined spaces
- Chemical handling
- Trenching and excavations
- Material Safety Data Sheets (MSDS)
- Biological hazards
- Traffic control and work site safety
- Lock-outs and Tag-outs
- Electrical and mechanical safety
- Pneumatic and hydraulic systems

Safety equipment should be maintained for the staff to perform daily activities and undertake any emergency repairs. Staffing levels should be adequate to assign an appropriate number of staff to tasks with inherent risks.

b. Customer Service

A customer service and/or public relations program should address any incoming inquiries, requests and complaints. A record of all inquiries, requests and complaints should be kept and should include date received, location, customer information, date resolved, etc. When receiving reports of **BBs**, staff should gather information, if available, on depth of flooding in basement, whether the backup was preceded by a storm event, whether there was a power outage prior to the **BB**, and how long it took for the backup to recede. **Satellite entities**' **LTOMP**s must include protocols for handling inquiries, requests and complaints from the public.

c. Management Information Systems

A Computerized Maintenance Management System (CMMS) should be used to effectively manage current information related to the collection system. A CMMS system should be able to track and maintain records of customer service, emergency response, inspections, monitoring, compliance, **maintenance**, asset inventory, equipment and supply inventory, etc. **Satellite entities**' **LTOMPs** must include a description of the system used to track the aforementioned information about the **sanitary sewer** system.

A Geographical Information System (GIS) should be used to map and locate facilities and provide information on all municipal infrastructure (material, size, elevations, etc.). The GIS and CMMS systems should be integrated.

d. SSO/BB Notification Program

A procedure must be established for reporting an **SSO** to appropriate parties, when required. Such entities may include the **IEPA**, drinking water officials, public health officials, transportation officials or the general public. A summary of **SSOs** and **BBs** must be provided to the **District** annually. Information about each **SSO** and **BB** that occurs within a **sanitary sewer** system, whether in the private public sector, must be recorded on the *Sanitary Sewer Overflow or Basement Backup Satellite Entity Internal Summary Form*. Typical information recorded about the **SSO** event includes date, time, location, cause, volume, how it was stopped and remediation actions and methods. A procedure for cleaning a site following an **SSO** should also be included in the **LTOMP**.

A procedure must be established for responding to and inspecting **BBs**. Typical information recorded on the aforementioned form about the **BB** event should include: date, time, location, cause, volume, how it was stopped, remediation actions and methods, depth of flooding in basement, whether the backup was preceded by a storm event, whether there was a power outage prior to the **BB** and how long it took for the backup to recede.

e. Emergency Preparedness and Response

Satellite entities' **LTOMP** must include a written plan for both routine and catastrophic emergencies. These emergencies include **SSOs**, **BBs**, sewer breaks or collapse, power outages at lift stations, etc. The emergency response plan should utilize the most current information about the collection system and should be available to the staff. For larger systems, the collection system should have a risk assessment, identifying areas where the collection system is vulnerable to failure, as well as the effect failure would have to system operation, equipment, public safety and health. A risk assessment should consider the vulnerability of the system to the following:

- Extreme weather events and other natural disasters;
- Work stoppages;
- Accidents; and

- Improper **maintenance** or negligence.

Once vulnerable areas are known, appropriate plans should be in place to ensure system operation continues for the duration of the emergency. Plans should address contingencies for emergency conditions, including:

- Inaccessibility of equipment or system components;
- Equipment failures;
- Power outages; and
- Lost or difficult communication caused by noise, equipment failure, or service outages.

Plans should identify all steps that staff should take in the event of emergency situations. Plans should also indicate when they should be initiated and terminated. Finally, plans should detail the type of equipment that should be used in various situations and how operations should be performed.

Typical components of an emergency program may include the following:

- General information, such as telephone numbers of personnel, fire department and ambulance;
- Identification of hazards with classification, e.g., flammable, energized electrical circuits, etc.;
- Risk assessment for vulnerabilities which identifies what type of emergencies that could occur;
- Emergency response procedures;
- Methods to reduce the risk of emergencies;
- Responsibilities of staff; and
- Continuous training.

Emergency procedures should be understood and practiced by all staff. Records of all past emergencies should be kept in order to constantly improve response training and the method and timing of future responses. If resources are limited, consideration should be given to contracting other departments or private industries to respond to some emergencies.

2. Mapping

Satellite entities are required to have an accurate, current map of their **sanitary sewer** system. This map shall be submitted to the **District** as soon as it is available, but no later than the time at which the **LTOMP** is submitted to the **District**. Chapter 2 of the 1989 Manual discusses sewer mapping. An accurate map of the location, size, depth, material, and age of the **sanitary sewer** system including appurtenances is vital for effective operation and **maintenance** activities. The map must also show the extent of the **satellite entity's** sewer system service area. Many satellite sewer system owners will have area maps and section maps. Area maps are drawn at a larger scale and help orient the reader to the area of interest. A section map can then be consulted for detailed information about the sewer system in one area. Sewer system maps should be developed, if they do not currently exist, or updated prior to developing and implementing **maintenance** activities.

Maintenance of the sewer map by updating all relevant information about the collection system is vital. Maps should contain the following information:

- All mainline sewers and force mains;
- Manholes and cleanouts;
- Lift Stations, siphons, diversion structures, overflows and bypasses;
- **Building** and house laterals' connection points to mainline sewer;
- Service area boundaries[1];
- Roads, water bodies, etc.;
- Connections to **District** facilities;
- All relevant elevations, diameters, sizes, and materials of the above; and
- The footprint of **buildings** served by the public sewer system (for **satellite entities** that have digitized maps, as described below).

[1] Examples of the types of service area boundaries that should be shown on a sewer map, if applicable in a particular **satellite entity** include: **combined sewer areas**, **separate sewer area**s, unsewered areas, areas that are tributary to a particular **District** treatment plant (if the **satellite entity** discharges to more than one treatment plant), and areas tributary to the **District** versus another sanitary district.

The maps should have a permanent numbering system to uniquely identify all manholes and cleanouts, and these numbers should never change. Manholes should be labeled with rim and invert elevations. Sewer lines should indicate the diameter, length between manholes, material, and slope or direction of flow. The maps should also have access and overflow points, a scale, and a north arrow. It is recommended that **regulatory floodplains** be shown on the maps, as well as other utilities such as **storm sewer** and water mains, as long as the information about **sanitary** and **combined sewers** remains clearly visible. The maps should also have the date the map was drafted and the latest revision date.

A Geographical Information System (GIS) is preferable to be used for collection system mapping, as it is efficient to update. Information is more easily obtained from a map in GIS than from map in other formats (i.e., paper). GIS easily allows for the printing of maps at the user's choice of scale. Separate steps are not required to generate area maps and section maps, since a map book feature can be used to generate the large-scale map which facilitates locating specific information from a section map. Staff should be properly trained in the use of GIS mapping. Figure 8.16 shows an example of a **sanitary sewer** map in GIS format.

Figure 8.16. GIS-Based Sewer System Mapping

While many **satellite entities** in the **District** service area have already transferred their sewer maps to GIS, several still use paper maps. Transferring the mapping system to GIS is strongly recommended. In addition to the benefits mentioned above, adding new fields of information to the map can be accomplished more easily in GIS. Locating structures (such as manholes) in the field is easier because a current aerial photo can be switched on as a base map. Viewing sewer information - along with other information, such as locations of **storm sewers**, water mains, **floodplains**, gas mains, municipal boundaries, etc. is easier because feature classes of these types of data can be stored in the system and switched on and off as needed. Transferring sewer and utility data to GIS from paper requires an investment of monetary resources to purchase the software, digitize data, provide adequate computer hardware, and pay for future system upgrades. The transfer of sewer system data to GIS also requires an investment of staff time to check the electronic data and to learn how to use the new system. Satellite system owners considering transferring sewer system data to GIS are urged to take the necessary time to ensure that data being digitized is correct. If poor quality, erroneous data on paper maps is simply re-drawn in digital format, the data will still only be marginally useful. Therefore, it is recommended that a review of paper maps be made - especially in conjunction with transferring the sewer map to a GIS format - to identify and resolve issues such as missing rim and invert elevations, adjacent invert elevations that do not seem reasonable or realistic (such as a downstream manhole invert that is higher on a gravity line), **sanitary sewers** that do not connect to anything or dead-end at a manhole, and **sanitary sewer** sizes that seem unreasonable or unrealistic (such as a larger pipe connecting to a smaller downstream pipe). The most accurate method to build a **sanitary sewer** layer in a GIS system involves the establishment of an accurate GPS location for each manhole from recent field investigations.

Specific procedures should be established when correcting or entering new information into the GIS map. It is recommended that updates to sewer maps be handled by, or at least approved by, a single designated staff member. The procedure for updating maps should require updates to be made quickly. Typical items that would require periodic updating include:

- New sewer system extensions and additions;
- Changes to the sewer as a result of replacement or rehabilitation;
- Changes to appurtenances as a result of replacement or rehabilitation;
- Location of service lateral connections to the mainline sewer after a television inspection is completed, if such information is not already available;
- Corrections to map errors; and
- Documentation of completed rehabilitation work.

Satellite entities' **LTOMPs** must include a procedure for updating the **sanitary sewer** map. Updates to the sewer map shall be made annually, at a minimum.

3. Equipment and Collection System Maintenance

Every sewer system should have a well-planned, systematic and comprehensive **maintenance** program, with the goals of preventing and eliminating **SSOs** and **BBs**, maximizing service and system reliability at minimal cost, and establishing infrastructure sustainability. Procedures and instructions should be in place to describe the **maintenance** and repair approach of various systems and facilities.

Maintenance can be planned or unplanned. Planned **maintenance** activities include predictive and preventive **maintenance**. Unplanned **maintenance** consists of corrective and emergency **maintenance**. The goal is to reduce corrective and emergency **maintenance** through planned and predictive **maintenance**. Each **satellite entity's LTOMP** must include a description of how it approaches planned and unplanned **maintenance**.

a. Planned and Unplanned Maintenance

A planned **maintenance** program is a systematic approach to performing **maintenance** activities to avoid equipment or system failure. Planned **maintenance** includes both predictive and preventive **maintenance**. A well planned **maintenance** program should reduce capital repair and replacement costs, reduce **SSOs** and **BBs** and improve and sustain public confidence in the sewer system.

Predictive **maintenance** activities include assessment and inspection of equipment and the system, and monitoring equipment can be used to detect early warning signs of failure. Predictive **maintenance** also takes previously recorded information into account to determine how and when the system will deteriorate over time.

Implementing an accurate recordkeeping system of inspection activities will provide a baseline condition of the system which can then be used to implement an effective predictive **maintenance** program that identifies potential problem areas and trends that could affect equipment and system performance. This can be achieved by utilizing a CMMS. Identification of these areas will offer an early warning and shift a corrective or emergency task to a planned task.

An effective predictive **maintenance** program will minimize costs, reduce environmental and public health impacts, reduce the need for corrective and emergency repairs, and increase the useful life of the equipment and system.

Maintenance of mechanical equipment, such as lift stations, should be based on the manufacturer's recommendations. A **maintenance** card or digital record should be kept for all equipment within the **sanitary sewer** system. Records should be kept for all equipment that details **maintenance** recommendations, schedule and instructions as well as any **maintenance** activities conducted.

The schedule of sewer inspections, cleaning, root removal, repair, rehabilitation and replacement activities should be based on recorded inspection data. It should be noted that regular frequencies of cleaning, inspection and root removal may not be necessary and could be inefficient. In many cases a small percentage of the system has the most problems; therefore, the **maintenance** schedule should be based on the recorded inspection data.

Unplanned **maintenance** activities take place in response to equipment and/or sewer breakdowns or failures. Unplanned **maintenance** may be corrective or emergency **maintenance**.

Corrective **maintenance** occurs as a result of preventive or predictive activities or a non-emergency which has been identified as a problem situation. Emergency **maintenance** occurs when a failure occurs creating an environmental hazard, public health hazard, or a hazard to the related system or equipment.

Corrective **maintenance** activities may draw resources away from predictive and preventive **maintenance**. When corrective **maintenance** activities become predominant, planned **maintenance** may not be performed, leading toward an increase of corrective and emergency **maintenance** activities.

Emergency crews, or on-call emergency crews, must be in place for 24-hour-a-day, year-round operation to respond to emergency **maintenance** activities. A procedure should be established detailing the type of action to take, necessary equipment and the personnel required.

b. Sewer Cleaning

Satellite entities' **LTOMP** must include a protocol for sewer cleaning.

The purpose of sewer cleaning is to remove accumulated material, to prevent blockages and to prepare the sewer for inspections. The major methods of sewer cleaning include hydraulic, mechanical and chemical cleaning. Table 8-6 was developed by the **USEPA** and shows the relative effectiveness of various sewer cleaning methods that address specific issues commonly encountered in sewers. Sewer cleaning methods, and their respective advantages and disadvantages, are discussed on pages 5-1 through 5-40 in the 1989 Manual.

Hydraulic cleaning is the application of pressurized water to clean the sewer. Such methods include balling, high velocity cleaning with a nozzle and flushing. Mechanical cleaning uses a device to scrape, cut or pull material from the sewer. Such methods include sewer scooters, bucket machines, scrapers and power/hand rodders. Many local sewer system owners have access to combination vacuum/jetting trucks, like the one shown in Figure 8.17, to address a variety of sewer cleaning tasks.

Figure 8.17. Vacuum/Sewer Cleaning Truck (Source: Anaheim Truck & Auto Service, Inc.)

Another element of sewer cleaning, chemical cleaning, is commonly used to control roots, but can also be used to manage accumulated grease.

Roots are a concern for owners of sewers not only because they can grow inside of the sewers and block flow, but also because they can widen existing cracks or joints in the sewer, which may lead to increased **groundwater** infiltration. Roots can be removed through mechanical means such as rodding and jetting with cutting heads, however, chemical treatment is usually required in conjunction with these methods due to roots' tendency to grow back.

Some products designed to kill roots contain copper. Due to potential toxicity to microorganisms at downstream wastewater treatment plans, the use of products containing copper is not recommended. Active ingredients used in common root control chemicals include diquat dibromide and metam-sodium. Both can have harmful impacts on humans and the environment if they are not used as directed, but byproducts created when metam-sodium breaks down, particularly the gas Methyl isothiocyanate (MITC), pose significant health risks. The EPA restricts the use of metam-sodium products within 50 feet of a manhole in order to minimize the risk of exposure of bystanders to MITC.

Foam is the only available application method for metam-sodium and diquat dibromide root control products.

In recent years, an increase in sales of non-woven fabric wipes, particularly those that are not marketed as baby wipes, has correlated to increased incidences of blockages in sewers and pump station failures due to clogging. Several local sewer system owners have seen a sharp increase in the number of manhours dedicated to sewer cleaning associated with wipes and other debris that become trapped once they are in the sewer system. One of the most significant instances of this was the formation of a 15-ton bus-sized mass of debris in a London interceptor, given the nickname "fatberg." Discussions between industry groups representing wastewater collection facility owners and non-woven fabric manufacturers continue with the goal of finding a solution to conflicting recommendations for durability of wipes. In the meantime, sewer system owners need to be aware of the trend. They may consider initiatives to educate the public that inappropriate materials flushed down toilets can cause clogged pipes, service disruption and ultimately, increased sewer service rates.

Accurate records are needed to indicate which areas of the **sanitary sewer** system are susceptible to blockages. The records will aid in the development of a cleaning cycle to address problem areas more frequently. Potential problem areas should be identified, preferably on a map. Problem areas include: grease/industrial discharges, hydraulic bottlenecks, sewers with insufficient slope, areas prone to root intrusion, etc. An effective and economical cleaning cycle must be determined by each **satellite entity**. Cleaning is required prior to scheduled inspection and rehabilitation work.

Table 8-6. Relative Effectiveness of Sewer Cleaning Techniques
(Source: USEPA, 2002, Collection Systems O&M Fact Sheet Sewer Cleaning and Inspection)

Solution to Problem	Emergency Stoppages	Grease	Roots	Sand, Grit, Debris	Odors
Balling		●		●	●
High Velocity Cleaning	•	●		●	●
Flushing					●
Sewer Scooters		●		●	
Bucket Machines, Scrapers				●	
Power Rodders	●	•	●		
Hand Rods	●	•	●		
Chemicals		●	●		●

● = Most effective solution for a particular problem

• = Least effective solution for a particular problem

Source: U.S. EPA, 1993.

c. Lift Stations

Proper lift station operation, **maintenance** and repair typically requires electrical, hydraulic and mechanical knowledge. Lift station failure may damage equipment and endanger the environment and public health as a result of an **SSO**.

Information regarding lift station operation and equipment should be maintained to the fullest extent possible. Key operational parameters should be maintained in an organized and accessible manner and should be readily available to operators at all times. Key operational data to be collected and kept current include the following:

- Station drawings;
- Wet well dimensions and key elevations;
- Pump on/off levels;
- Level of influent pipes and tributary sewers relative to on/off set points;
- Pump model(s) and impeller trims;
- Pump curves and design points;
- Size of pump discharge piping and force mains;

- Types and condition of valves;
- Manufacturer data sheets for mechanical and electrical equipment; and
- Calibration records for level and flow monitoring equipment.

The lift station O&M manual should consider the variation of equipment types, configuration, etc., and should contain written procedures for the following:

- Automatic or manual pump rotation and frequency;
- Wet well operation levels to limit pump starts and stops;
- Procedure for manipulating pump operations during wet weather to increase in-line storage of wet weather flows;
- How flow is measured (if applicable) and how the collected data is used;
- Assessing whether the lift station has capacity related or **maintenance** related overflows, and whether overflow monitoring is and should be provided;
- Primary means of level control;
- Use of floats for primary or backup level control;
- Whether there is a history of power outages and a source of emergency power; and
- Procedure for regularly exercising the emergency generator (if present) under load.

d. Force Mains

When properly designed and maintained, force mains can have a useful life comparable to that of a gravity sewer. Annual force main route inspections are recommended to ensure normal functioning and to identify potential problems. Special attention should be given to the integrity of the force main surface and pipeline connections, unusual noise, vibration, pipe and pipe joint leakage and displacement, valve arrangement and leakage, lift station operation and performance, discharge pump rates and pump speed, and pump suction and discharge pressures. One common method of determining the condition of the force main is by routine pump station calibration. If this is done on an annual basis, any changes in capacity and discharge head in the pump station can be identified. Because these changes could also be attributed to pump wear, it is essential to verify that the pumps are in good working order before determining that the force main needs cleaning.

4. Material and Equipment

An inventory of spare parts, equipment and supplies should be maintained and based on the manufacturers' recommendations and/or historical records. This inventory will reduce the down time of the **sanitary sewer** system in the event of a failure. It is recommended that frequently used items be kept in stock as well as parts that are difficult to obtain. Safety equipment used by the sewer **maintenance** crew should also be included on the equipment inventory.

Basic equipment inventory should include: type, age and description of the equipment, manufacturer, fuel type (as applicable), year of acquisition, estimated year for replacement and other special requirements, operating costs and repair history.

Satellite entities' LTOMPs shall indicate which person or position is responsible for developing and maintaining the equipment inventory, and the process for obtaining spare parts, supplies and replacement equipment.

Chapter 8 of the 1989 Manual contains lists of equipment and materials that are commonly needed by sewer **maintenance** crews. In addition to the material and equipment listed in the 1989 Manual, it is recommended that sewer **maintenance** crews have access to metal detectors to facilitate finding buried manholes, smartphones to facilitate communication and photographing conditions, semi-permanent spot marking paint, tripod and cable on a winch for safe confined space entry, and picks or keys required to open locked manholes.

5. Sewer System Capacity Evaluation

An evaluation of the capacity of the **sanitary sewer** system may be required in either of the following situations:

- An area experiences dry weather **SSOs** and **BBs** that cannot be attributed to **maintenance** issues or deteriorated sewers; or
- An area is being developed or redeveloped and the projected dry weather flow exceeds that of the current land use.

The capacity evaluation begins with an inventory and characterization of the **sanitary sewer** system components. Most of this information should be available on the **sanitary sewer** system map.

The inventory should include the following basic information:

- Population served and service area;
- Total system size;
- Inventory of length, size, material, age and condition, if available;
- Inventory of appurtenances such as lift stations and siphons, including size, capacity, material, age and condition, if available;
- Manhole rim and inverts;
- Sewer slopes and inverts;
- Force main locations, length, size, material and condition, if available; and

- Location of laterals.

The WMO (§703) provides the standards by which **sanitary sewers** are to be sized and also establishes standards for design capacity of sanitary lift stations (§702.2.E.2). If areas within a **sanitary sewer** system lack the capacity to handle dry weather flow, according to the aforementioned WMO and TGM standards, the **satellite entity** may undertake system improvements to provide the required dry weather capacity. Such improvements require a WMO permit from the **District**.

6. Sewer System Inspection and Condition Assessment

A continuous sewer system inspection program is an important part of a preventive **maintenance** program. Inspections are required to identify and locate I/I sources, reveal blockages in the system, and to identify structural defects. Sewer defects can cause **SSOs**, **BBs**, sewer surcharging, exfiltration of wastewater into the ground, collapse of roadways and an increase of deposits in the sewers and lift stations. A continuous inspection program will identify system defects, and schedule them for repair before they cause a system failure, which would result in an emergency repair. An inspection program should include: sewers, force mains, manholes, lift stations and other appurtenances. Smoke testing and dye water testing can be used in problem areas to identify sections of the system that require detailed inspections. I/I sources can only be identified and corrected if a continuous inspection program is implemented.

Although **satellite entities**' high risk **sanitary sewers** will be inspected under the Short Term Requirements, the **LTOMP** must address inspection of the entire public **sanitary sewer** system. Classification of the entire **sanitary sewer** system, including gravity lines, manholes, lift stations, and force mains, into high-, medium-, and low-risk categories is recommended for forming the basis of establishing the frequency of sewer inspection and condition assessment. Figure 11-3 in the 1989 Manual provides recommendations for frequency of inspection based upon the characteristics of the community. **Satellite entities**' **LTOMP** must include a description of the continuous sewer system inspection program which shall detail the frequency of inspection for various portions of the **sanitary sewer** system as well as the inspection method to be used. A goal is to inspect the entire public **sanitary sewer** system on a 10-year cycle. At a minimum, two percent (2%) of the **sanitary sewer** system must be inspected each year. As discussed under the Short Term Requirements, inspections shall be conducted according to NASSCO standards, or an approved equivalent system of standards. NASSCO codes can be used to prioritize rehabilitation work.

PACP® condition ratings are meant to be objective and should be coded by trained and experienced technicians familiar with the rating system. Structural defects with a rating of 5 indicate an imminent collapse and should receive immediate attention. O&M defects commonly include root penetration, sedimentation, and buildup of fats, oils and grease (FOG). A rating of 5 indicates a significant or near-total blockage. Each pipe segment is assigned a quick rating which indicates the severity of the most significant defect on the segment as well as the overall condition of the segment.

PACP® inspection databases can be used in a GIS or CMMS to map individual defects, and full pipe segments can be thematically coded to prioritize segments for more frequent re-inspection cycles or for long term budgeting for O&M and rehabilitation.

On a long term basis, it is crucial to maintain consistency in the review and categorization of defects. To this end, it is important that **satellite entities** performing condition assessments in-house have staff available who have received proper PACP®, MACP® and LACP® training and certifications as well as training in defect coding software compatible with CMMS systems. Work contracted to others should be expected to follow the same standards for ease of integration with condition assessment data collected by others.

The **satellite entity** can utilize the NASSCO rating systems for long term O&M in the following ways:

1. Defects can be individually graded so that pipes can be prioritized based on severity and cross-referenced with criticality and consequence of failure. This results in focusing rehabilitation funds where they will have maximum impact.
2. Defect databases can be maintained and used to compare previous inspections for changes or deterioration to prioritize the frequency of re-inspections.
3. Pipe segments subject to FOG build-up can be mapped and prioritized for more frequent re-inspection and cleaning cycles.
4. Service connections can be mapped along the sewer segment minimizing excavations during future repairs.
5. Data can be used to update the GIS for material, size, and condition.

Electrical current leakage testing (currently a proprietary technology of Electro Scan, Inc.) may be used in conjunction with or as an alternative to CCTV to identify sources of infiltration or exfiltration along pipelines that may not be visible by CCTV inspection. This method can be used for pipes of any non-conductive material, and it provides a quantifiable, objective measure of a pipe’s potential for leakage. The main advantages of this technology compared to CCTV are as follows:

- Inspections and quantification of defects can be conducted more quickly than CCTV.
- Sources of infiltration that are not visible from CCTV inspection are frequently identified.
- The portion of the pipe below the flow line can be inspected more easily than with CCTV.
- Defects in lined sewers, which are often undetectable on CCTV, can be located.
- Defects are quantified by their estimated I/I contribution in units of flow.

Disadvantages, as compared to CCTV are as follows:

- Inspections do not provide a visual image of the defects.
- Defects are not coded according to PACP® condition ratings.
- The method cannot be used on metal pipes or any other conductive pipe material.

While Electro Scan does not replace CCTV as a PACP® inspection method, it can be used as a way to prioritize subsequent CCTV inspections and to supplement CCTV by identifying additional sources of leakage. The technology is also effective at certifying pipe lining by detecting small sources of leakage not visible from CCTV.

Acoustic Emissions Testing (AET) is a form of pipeline inspection that can be used to inspect force mains, siphons, or other pressure pipes that CCTV is unable to inspect. AET must be conducted while a pipe is full, allowing a pressure pipe to be tested while still in service. The SmartBall developed by Pure Technologies is one form of this technology which can inspect very long pipelines using just two points of access — one to insert the unit and one to retrieve it — by emitting acoustic signals and monitoring their activity as the inspection unit travels along the pipeline.

Another type of acoustic testing is used in gravity sewer pipes to locate potential blockages by sending an acoustic signal between manholes from the surface. The Infosense SL-RAT is one example of this technology. Compared to CCTV, it has the following advantages:

- Inspections are much faster than CCTV.
- Inspections can be conducted from the surface, reducing the need for personnel to perform confined space entry.
- The method utilizes smaller, more mobile equipment.

Limitations of the method include the following:

- Only locations of potential blockages are detected.
- CCTV is required to identify both the type and location of the blockage.
- It is more effective for smaller diameter pipes.

Although it cannot replace CCTV, acoustic testing can be a fast, low-cost method for prioritizing where to use CCTV and for locating potential blockages. It has been proven effective in reducing the risk of **SSOs** caused by reductions in pipe capacity.

Satellite entities must have a program for inspection of new **sanitary sewer** facilities, both publicly owned and privately owned. Requirements for inspection in conjunction with new construction shall be contained in **satellite entities**' ordinances. Written procedures for the inspection of new construction, including inspection checklists, must be included in the **LTOMP**.

7. Sewer System Rehabilitation and Updating the CIP

   A sewer system rehabilitation program should be established with the objective of maintaining the conveyance capacity of the sewer system. This is accomplished by ensuring structural integrity, limiting the loss of conveyance capacity due to excessive I/I, and limiting potential **groundwater** contamination by controlling exfiltration. The rehabilitation program should be based on all recorded information from all **maintenance** and observations made as part of the capacity evaluation.

   The type of rehabilitation method depends on several pipe characteristics such as age, material, size, location, sewer flow, surface condition, severity of I/I, etc. Rehabilitation methods include replacement, lining, grouting, joint sealing, etc. The rehabilitation program should identify methods that have previously been used successfully to guide methods to be utilized for subsequent sewer rehabilitation. Chapter 6 of the 1989 Manual describes standard rehabilitation methods. In addition, the WEF Manual of Practice FD-6 contains detailed information about current rehabilitation methods.

   Rehabilitation procedures for manholes often involve modifications to covers and frames, which are common entry points for extraneous flows to the system. One such source is from manhole covers with open pick holes located in low-lying or flood-prone areas. The two references mentioned above outline several solutions that will reduce inflow from such manhole covers, which are among the least expensive ways to reduce inflow. In addition, adjustments to the manhole frame can also be completed to restore the watertight seal between the frame and the manhole. Infiltration through leaky manhole walls can be repaired by injecting chemical grouts or installing rubber joint seals at leaking manhole section joints. Manhole restoration methods include coating, patching, plugging and installing a structural lining. Figure 8.18 illustrates application of cementitious lining inside of a manhole. The method used depends on the causes of deterioration, whether the manhole is still structurally sound, and the extent of the damage. Refer to Pages 6-3 through 6-7 of the 1989 Manual for more detailed information on manhole rehabilitation.

Figure 8.18: Manhole Rehabilitation by Cementitious Lining

Rehabilitation methods for sewer pipes include open cut and trenchless methods. Many sewer pipes can be repaired from inside the pipe, but in cases of extensive structural damage, a complete replacement of the sewer pipe may be necessary. The most common rehabilitation methods for sewer pipes include:

- Cured-in-place-pipe (CIPP) lining – lining a section of pipe (usually between two manholes) by inserting a "sleeve" (usually polyester or fiberglass) that is saturated with a resin. When the sleeve is inflated with water or air, the resin is hardened using heat, which forms a liner within the existing pipe. Service connections to the pipe are re-established by cutting openings in the lining. This method cannot be used to rehabilitate pipe sections with severe deformation. Figure 8.19 shows the CIPP lining process.

Figure 8.19: Cured-in-Place Pipe (CIPP) Lining

- Sliplining - a new pipe, usually made of HDPE, is pulled into the existing sewer. With structural grouting of the annual space between the existing and new pipes, this is a structural repair. Excavation at the insertion and receiving pits is necessary, and re-establishing service laterals also requires excavation. This method reduces the inside diameter of the sewer more significantly than CIPP does.
- External grout injection – injecting chemical or cement-based grouting to stabilize soils, fill underground voids and reduce **groundwater** movement. Since the grout has to be injected exactly where known leaks exist, the external grouting method is better suited for stabilizing soils rather than sealing out infiltration.
- Internal joint sealing – the most commonly used method for sealing leaking joints in sewer pipes and involves sealing the leaking joints or cracks using a chemical grout gel. Chemical grouting can be performed for sewers flowing partially full, and maximum flow depths have been prescribed by NASSCO for effective chemical grouting.
- Point repairs - these repairs usually address a damaged section of pipe and require excavation. They may be used in conjunction with other repair methods, such as CIPP lining.
- Pipe replacement – excavation and replacement of damaged pipe. Although likely to be the most expensive option, replacement may be warranted when an increase in pipe size, change in alignment, etc. is needed in addition to the rehabilitation work.

Additional information on the methods described above can be found on pages 6-8 through 6-16 of the 1989 Manual as well as in the WEF Manual of Practice FD-6.

Because lateral connections may contain excessive defects, repairs to these service connections can also significantly reduce inflow and infiltration into the system. As outlined in Chapter 6 of the 1989 Manual (Page 6-16), there are multiple options available for rehabilitation of lateral connections: (1) variations of the standard chemical grouting method that utilize specialized television cameras, which is illustrated in Figure 8.20, (2) CIPP lining, and (3) complete replacement is also a consideration.

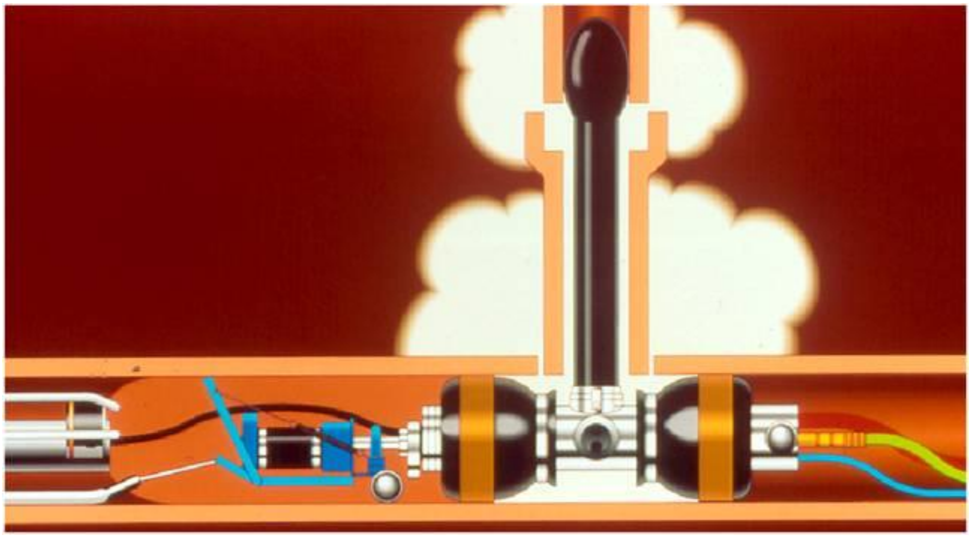

Figure 8.20. Lateral Rehabilitation by Injection Grouting

Table 6-1 on Page 6-19 of the 1989 Manual provides a summary of the most common sewer rehabilitation methods along with their associated advantages and disadvantages. In addition, Table 6-2 on Page 6-21 of the 1989 Manual provides a summary of the service lives for repairs to the sewer system.

The cost of the rehabilitation work should always be compared to the replacement cost of the system component before making a decision on which corrective measure to implement. For severely deteriorated components of the sewer system, it may be more cost-effective to perform a complete replacement instead of rehabilitation. Other items that may also factor into the decision-making process include safety, potential utility conflicts, the need to maintain existing sewage flows and traffic disruption. Prior to choosing a corrective action (rehabilitation vs. replacement), the service lives of the repairs should also be taken into consideration.

Each **satellite entity's** rehabilitation program should prioritize rehabilitation work according to severity of defects, age of the sewer, expected impact of sewer failure, anticipated public works projects in the vicinity that may provide an opportunity to perform sewer rehabilitation and available funding/resources. The **LTOMP** must include an explanation of the process used by the **satellite entity** to prioritize sewer rehabilitation projects.

Rehabilitation projects that will be performed by contractors should be included on the **satellite entity's** CIP. The CIP developed under the Short Term Requirements shall be updated as projects are completed and as new areas requiring rehabilitation are identified under the inspection program of the **LTOMP**. The CIP should include the fiscal year in which capital improvements are to be undertaken, the anticipated start date, the **District** permit number, the anticipated cost, a project description, and the priority of the project.

Completed rehabilitation work should be tracked on the **sanitary sewer** system map. Information to be included in the sewer system database includes contract number for rehabilitation work, date work was performed, rehabilitation method, and contractor.

The severity of the defects to be addressed under sewer rehabilitation efforts should be a significant factor in determining the budget necessary to support the CIP. **Satellite entities** are encouraged to allocate a portion of annual revenue for a capital improvements reserve fund so that resources are available to undertake capital improvement projects when necessary. Options for funding rehabilitation projects other than a reserve fund include assessments from a special service area and State Revolving Loan Funds.

8. Funding Plan

Satellite entities must secure a funding source to continually implement the **LTOMP**.

Funding can come from various sources, including service fees for sewer and water usage. The system owner should track all costs in order to have accurate records each time the annual operating budget is developed. An annual baseline provides documentation for future budget considerations and provides justifications for any future rate increases if they are needed.

The key components in an annual operation budget are the cost of preventive and corrective **maintenance** and major collection system repairs and improvements. There should also be an annual budget of discretionary and non-discretionary items. The annual budget should also address CIP projects, as discussed above.

Satellite entities may also utilize sources such as **IEPA** State Revolving Fund (SRF) loans or federal loan or grant programs to fund rehabilitation and repair costs. Low-income areas may be eligible for community development grants, or areas impacted adversely by flooding, particularly those served by combined sewers, may be eligible for disaster relief or green infrastructure programs. These funding sources typically require advanced planning and lead time, as well as adequate economies of scale, in order to be utilized effectively. Therefore, they are typically considered potential funding sources for preventative **maintenance** and rehabilitation, such as sewer lining or replacement and combined sewer separation, and not for emergency repairs or routine **maintenance**, such as cleaning and televising.

Categories of operating costs are labor, utilities and supplies, and outside contractors. These categories should include information on unit costs, total costs and the amount or quantities used.

The system owner should track all **maintenance** costs throughout the year, including those associated with contracted services, so that the budget is based on representative costs of the previous years. The budget should be developed by using past records that are usually categorized as preventive **maintenance**, corrective **maintenance**, projected repair requirements and actual repair requirements.

Costs for emergency repairs should be a relatively small percentage of the entire budget. Emphasis should be placed on planned **maintenance** to avoid costly emergency repairs. An emergency reserve may also be established as part of the budget. The budget should also consider including a **maintenance** work backlog. The labor portion of the budget should be consistent with local pay rates and staffing needs.

Though not a means to accomplish I/I removal, potential sources of funding for work on private service laterals are sanitary service lateral warranty insurance programs. These programs have been developed by private companies and are marketed directly to homeowners or through the local community. These private companies typically retain local plumbers and contractors to perform the covered service lateral repairs. Property owners in these programs typically will pay a monthly fee, and the insurance will cover all or most costs associated with repairing the portion of the external service lateral that is damaged, clogged with roots, collapsed, and etc. It should be noted that lateral insurance does not cover repairs to address I/I, such as the lining of laterals due to leaking joints. Only the portion of the service lateral owned and maintained by the homeowner is covered. These service lateral warranty insurance programs do not typically cover costs related to replacing trees or shrubs damaged or removed during the repair, damage from sanitary backup into the home from the main sewer, replacement of the entire lateral (unless the entire lateral is damaged) or costs above a pre-determined annual cap for all repairs.

Satellite entities' **LTOMP** must indicate how annual operating costs, emergency repairs and capital improvements will be funded. **Satellite entities** must report their annual budget and the actual amount spent on their **LTOMP** each year to the **District**.

9. **Private Sector Program (PSP)**

As discussed earlier, all **satellite entities** must develop a **PSP** which will be implemented in conjunction with the **LTOMP**. **Satellite entities** will be required to report activities performed under the **PSP** to the **District** each year.

Entities may also wish to incorporate the inspection and repair of private service laterals with public sewer and road improvements when excavations expose or make private laterals more accessible to work crews.

Though typically more characteristic of a short term program, smoke testing can be employed as part of a long term program to determine the effectiveness of remediation of I/I sources identified during a short term program. Smoke testing can also identify private sector defects on sewer laterals, which are subject to progressive deterioration and would be more costly to individually inspect by CCTV. Smoke testing can identify which laterals need follow-up CCTV to recommend repairs.

10. Sewer Use Ordinance and Enforcement

To run an effective **sanitary sewer** operation and **maintenance** program, **satellite entities** must have the authority to do the following:

- Control the quantity and quality of wastewater from new developments and satellite collection systems;
- Control I/I sources ;
- Control sources of fats, oils and grease (FOG);
- Require proper design and construction of new and rehabilitated sewers and connections;
- Require proper installation, testing and inspection of new and rehabilitated sewers; and
- Access all components of the collection system.

This authority is commonly established by the adoption of a sewer use ordinance, though it may be established in service agreements or contracts as well, depending on the terms by which the **satellite entity** provides service to particular parties.

At a minimum, a sewer use ordinance will:

- Identify acceptable uses of the **sanitary sewer** system;
- Establish a procedure for obtaining authorization to connect to the sewer system;
- Establish enforcement measures or penalties for parties that violate the Sewer Use Ordinance;
- Describe regulations concerning industrial waste;
- Place limits on the quantity and composition of waste that is discharged to the system;
- Authorize the **satellite entity** to inspect new sewer construction; and
- Authorize the **satellite entity** to inspect private property for improper and/or illegal connections to the sewer system.

Satellite entities must have strict control over the nature and quantity of new flows introduced to their collection systems. **Satellite entities** must also establish design standards for sewer construction in both private and public sewer systems. These controls are normally implemented through a **building** permit process that involves design review and construction inspection by the **satellite entity**. Standards for new construction, procedures for reviewing designs, and protocols for testing, inspection and approvals should be established. **Satellite**

entities’ standards for design and construction of sewers must comply with **IEPA** and **District** standards, at a minimum.

In preparing design standards and reviewing proposed designs, **satellite entities** should emphasize ease of **maintenance**. Construction supervision should be provided by qualified staff, preferably a **Professional Engineer**. **Satellite entities** should ensure that **building** occupancy permits are not issued until all requirements pertaining to **sanitary sewer** construction are satisfied.

Satellite entities must submit copies of their sewer use ordinance(s) with the **LTOMP**. The **LTOMP** must describe the process for updating the sewer use ordinance. It must also include information about procedures and programs that the **satellite entity** has implemented to administer the sewer use ordinance(s).

The sewer use ordinance can be enforced using various means under the authority of the **satellite entity**. Penalties for non-compliance should be explicit and implemented in a fair and consistent manner. The mechanisms for enforcement available to the **satellite entity** include:

- Fines;
- Court orders;
- Shutoff of water service;
- Refusal to grant requests for additional service(s);
- Refusal to grant **building** permits for additions or modifications to the property; and
- Refusal to approve sale or transfer of a property.

Satellite entities considering the use of penalties to private property owners for non-compliance should be diligent in vetting ordinance changes with public officials, residents and other stakeholders.

Enforcement of sewer use ordinances may require inspection of private properties to verify compliance. Private property inspections can be conducted as a targeted program by the **satellite entity** with consent of the owners of properties being inspected. Other opportunities to inspect private properties include inspections for **building** permits, property transfers or water meter **maintenance**.

11. Template **LTOMP**

A template **LTOMP** is provided in Appendix D.

Additional Information to Support LTOMP Development and Implementation

Although not addressed specifically in Article 8 of the WMO, the following section addresses topics that are relevant to the management of **sanitary sewer** systems. In developing a comprehensive **LTOMP**, it is recommended that **satellite entities** consider addressing the topics discussed below.

<u>Flow Monitoring</u>

Flow monitoring provides information on dry weather flows and areas of the **sanitary sewer** system that experience wet weather flows from I/I sources. There are three types of flow monitoring techniques: permanent and long term monitoring, temporary and short term monitoring, and instantaneous monitoring. Permanent flow monitoring is performed at discharge points of the **sanitary sewer** system and lift stations. Temporary flow monitoring is typically done for 30 to 120 days and can be used to identify **sanitary sewer** subbasins with high wet weather flows and to evaluate pre- and post-rehabilitation work performance with I/I source removal. Instantaneous monitoring involves a single reading.

When a **satellite entity** decides to conduct flow monitoring, a flow metering plan should be established that describes the monitoring strategy and includes the frequency of inspection, service and calibration.

Flow metering performed for the purpose of quantifying I/I can be separated into three components: base flow, infiltration and inflow. Base flow is the flow generated by wastewater. Infiltration is the amount of **groundwater** that enters the **sanitary sewer** system through sewer defects and deficiencies. Inflow is the amount of **stormwater** runoff that enters the **sanitary sewer** system through direct connections.

For smaller **sanitary sewer** systems, where cost may prohibit the implementation of flow metering, other methods, such as a visual inspection at manholes, may be done during low-flow periods to determine if I/I flow is conveyed in the **sanitary sewer** system.

Basic procedures for conducting flow monitoring are addressed in the 1989 Manual on Pages 3-7 to 3-32. Flow monitoring programs typically fall into one of three categories:

- *Short term for the development of wet weather peaking factors*

  A reasonable relative ranking of subbasin wet weather flow response can be established with three or four storm events.

- *Short term for the development of wet weather flow/rainfall relationships*

  The correlation of peak wet weather flow response to rainfall intensity required to establish design storm peak wet weather flows and pre- and post-rehabilitation design storm peak flows typically requires at least six measurable (non-surcharging with an intensity of over 0.15 inches per hour) storms under similar medium to high antecedent moisture conditions.

- *Long term*

  Long term monitoring programs where flow meters are left in the **sanitary sewer** system are useful for tracking the reduction in wet weather flows in a multi-year investigation and rehabilitation program.

In addition to procedures in the 1989 Manual, flow monitoring must also include:

- Redundant depth sensors and a Doppler velocity sensor;
- Short term programs: Site calibration and meter **maintenance** during installation, upon removal, and on semi-weekly basis. If a meter's data is transmitted via telemetry, the frequency of these activities can be reduced.
- Long term programs: minimum of monthly calibration and site **maintenance** unless site is on data telemetry;
- Short term program monitoring interval of 15,000 to 25,000 linear feet;
- Long term monitoring interval of up to 100,000 linear feet; and
- Continuously recording rain gauge requirements of approximately one rain gauge per every eight flow meters with a minimum of two rain gauges.

Data Collection Requirements:

- Flow meters and rain gauges should log data at intervals of five minutes. If there are circumstances that necessitate extending instrument battery life, an interval of no greater than 15 minutes may be acceptable. The data logging intervals of flow meters and rain gauges should match to facilitate data analysis.
- Data shall be reviewed at least once per week during the first three weeks of installation. During this time, a minimum of two calibration readings should be taken to set data adjustment standards for the flow meters. This involves manually measuring velocity and depth at several locations within the flow profile, as shown in Figure 8.21. Crews will also make efforts to prevent sensor failure, minimize equipment **maintenance** issues, avoid excessive siltation and configure monitoring equipment to capture hydraulic variations or anomalies.
- Analyze the data to identify data gaps, hydraulic anomalies and meter performance.
- Data shall be corrected and adjusted according to field measurements, calibrations and flow balances among connecting sites.

Satellite entities should utilize GIS technology as a part of the **LTOMP**. Flow monitoring information, including installation data and all **maintenance** visits for each site, shall be delivered in a database format capable of integration into industry standard GIS systems. At a minimum, a mapping grade location for each equipment installation shall be provided and should be linked to an address (rain gauge) or manhole structure (flow meter).

If the area being monitored is sufficiently large, radar-derived rainfall data can be used to enhance the monitoring of rainfall by deriving rainfall at finer spatial resolution. NEXRAD radar data is typically used in conjunction with rain gauge data and specialized software to estimate rainfall totals at locations between gauge locations in a rain gauge network. Radar data, though not required, can lead to more accurate, localized rainfall measurements for flow meter analysis.

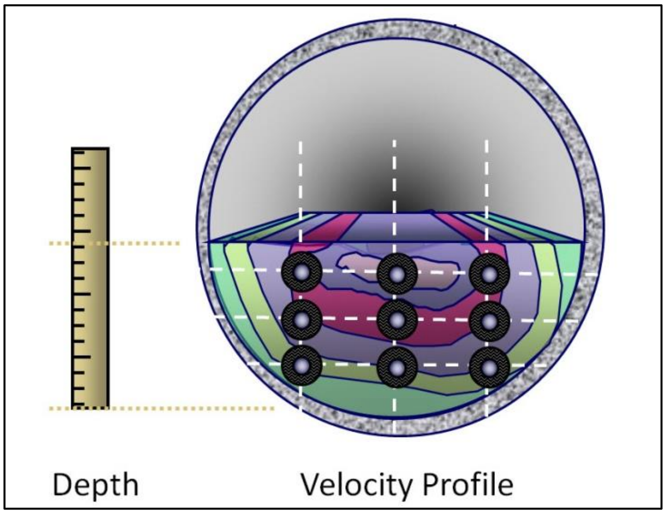

Figure 8.21. Manual Flow Meter Calibration

Determination of Wet Weather Peaking Factors

All **satellite entities** are required to conduct **sanitary sewer** condition assessments as part of the Short Term Requirements. In some cases, a history of reported **BB** locations and observed **SSOs** may allow for the prioritization of subareas in the **sanitary sewer** system for condition assessment activities. In many cases, however, lack of consistent reporting and recording of both **BBs** and **SSOs** will not provide enough information to prioritize subareas for condition inspection. In addition, **BBs** and **SSOs** may occur at the downstream end of the **sanitary sewer** system as a result of the total impact of all I/I defects upstream of these locations. Downstream hydraulic restrictions can also cause **BBs** and **SSOs**, which are related to system capacity more than to the level of wet weather flow. In these situations, **BB** and **SSO** history will not provide a reliable mechanism for prioritizing subareas for condition assessment.

Wet weather peaking factors generated from flow monitoring data can allow for the prioritization of **sanitary sewer** subareas for condition inspection activities. This approach can be coupled with available **BB** and **SSO** history to prioritize the subareas of the **sanitary sewer** system for condition assessment activities performed as part of the Short Term Requirements.

A flow monitoring program that is limited to the development of relative wet weather peaking factors among **sanitary sewer** subbasins can be designed with a shorter duration than a flow monitoring program designed to establish design storm peak wet weather flow rates for each subbasin. A reasonable relative ranking of subbasin wet weather flow response can be established with three or four storm events. However, the correlation of peak flow response to rainfall intensity required to establish design storm peak wet weather flows, and pre- and post-rehabilitation design storm peak flows typically requires at least six measurable (non-surcharge and over 0.15 inches per hour) storms under similar medium to high antecedent moisture conditions.

Methodology

1. Determination of Wet Weather Peaking Factors

   The wet weather peaking factor is the ratio of peak wet weather flow to average dry weather flow for all **sanitary sewer**s upstream of a flow monitoring location. A high ratio normally indicates a high concentration of high priority defects. A low ratio normally indicates a low concentration of high priority defects.

   Step 1- Determine Dry Weather Flow
   Dry weather flow can be determined from selecting the period during the flow monitoring program that is most isolated from rainfall and high **groundwater** periods. This “low flow” period should be at least one week in duration, and will in many cases include a “permanent infiltration” component. After selecting the dry weather flow period, a 24-hour diurnal flow curve can be established for each meter location. Establishing a weekend diurnal flow curve will improve the accuracy of the wet weather peaking factor determination when storm events occur on weekends. An example of a typical diurnal flow curve is shown on Figure 8.22.

   Step 2- Determine Peak Wet Weather Flow
   Peak wet weather flow after a significant storm event should be determined for all storms during the flow monitoring program. When flow monitoring is conducted with a tributary area of approximately 15,000 to 25,000 linear feet of main sewer, the sustained peak flow that occurs for 60 minutes should be selected. The 60-minute peak hourly flow is typically close to the time of concentration for subbasins of this size. Selection of average basin size smaller than this range will allow for more precise identification of subbasins with high infiltration/inflow with a proportionately higher level of effort in flow monitoring. Selection of average basin size greater than this will result in a less precise identification of subbasins with high infiltration/inflow. It is also preferable to maintain as uniform as subbasin size as possible. This will improve the ability to compare wet weather peaking factors from subbasin to subbasin while minimizing the impact of peak flow attenuation due to basin size. The longer the flow monitoring program is conducted; a larger number of storm events are likely to be monitored. This will also improve the accuracy of the wet weather peaking factor analysis.

   Storms that result in surcharging at the meter location should not be used in the peaking factor determination because the true measure of the peak flow that could be delivered to the flow meter location cannot be measured when the site surcharges. Peak wet weather flow for each storm event is then determined by subtracting the hourly diurnal dry weather flow from the storm induced peak hourly flow. An example of this determination is shown on Figure 8.23.

When pump stations are used as monitoring points instead of gravity flow meters, the most accurate method to determine peak wet weather flow requires a continuous closed pipe flow meter (either ultra-sonic/Doppler or electromagnetic) on the pump station force main coupled with continuous depth level recording in the wet well. If a force main closed pipe flow meter is not utilized, accurate timed calibration of the pump station discharge against wet well level is important. Utilization of pump station run time data only will typically underestimate peak flows.

Step 3- Determine Wet Weather Peaking Factor
Wet weather peaking factors are calculated for each storm at each flow monitoring location by dividing the peak wet weather flow by the average dry weather flow for the same time of day on the dry weather diurnal flow curve. Each flow monitoring site will then have an average wet weather peaking factor for all monitored storms. Storms with hourly intensity of less than 0.15 inches and storms that result in surcharging at a monitoring location will distort these ratios and should not be used in calculating the average wet weather peaking factor.

2. Ranking of Subbasins by Wet Weather Peaking Factors

   Subbasins can be ranked in descending order of wet weather peaking factors to establish a priority plan for sewer system condition assessment activities. An example of ranking process is shown on Figure 8.24. The subbasin ranking process can be used to prioritize subareas for condition assessment activities performed as part of the Short Term Requirements.

   In systems where it is likely to have large differences in permanent infiltration from subbasin to subbasin, or where subbasin size varies significantly, a more refined approach to determining wet weather peaking factors could be utilized. This more refined approach would involve the determination of linear feet of main sewer upstream of each flow monitoring location. Wet weather peaking factors would then be based on peak one hour wet weather flow length of main sewer (peak gpd/1,000 linear feet) and ranked in descending order.

3. Elimination of areas from Short Term Requirements condition assessment based on Wet Weather Peaking Factors

   Subbasins with very low wet weather peaking factors could be candidates for elimination from condition assessments under the Short Term Requirements and the **LTOMP**.

Additional guidance on wastewater flow components and flow monitoring planning is also available on Pages 3-1 to 3-11 of the 1989 Manual.

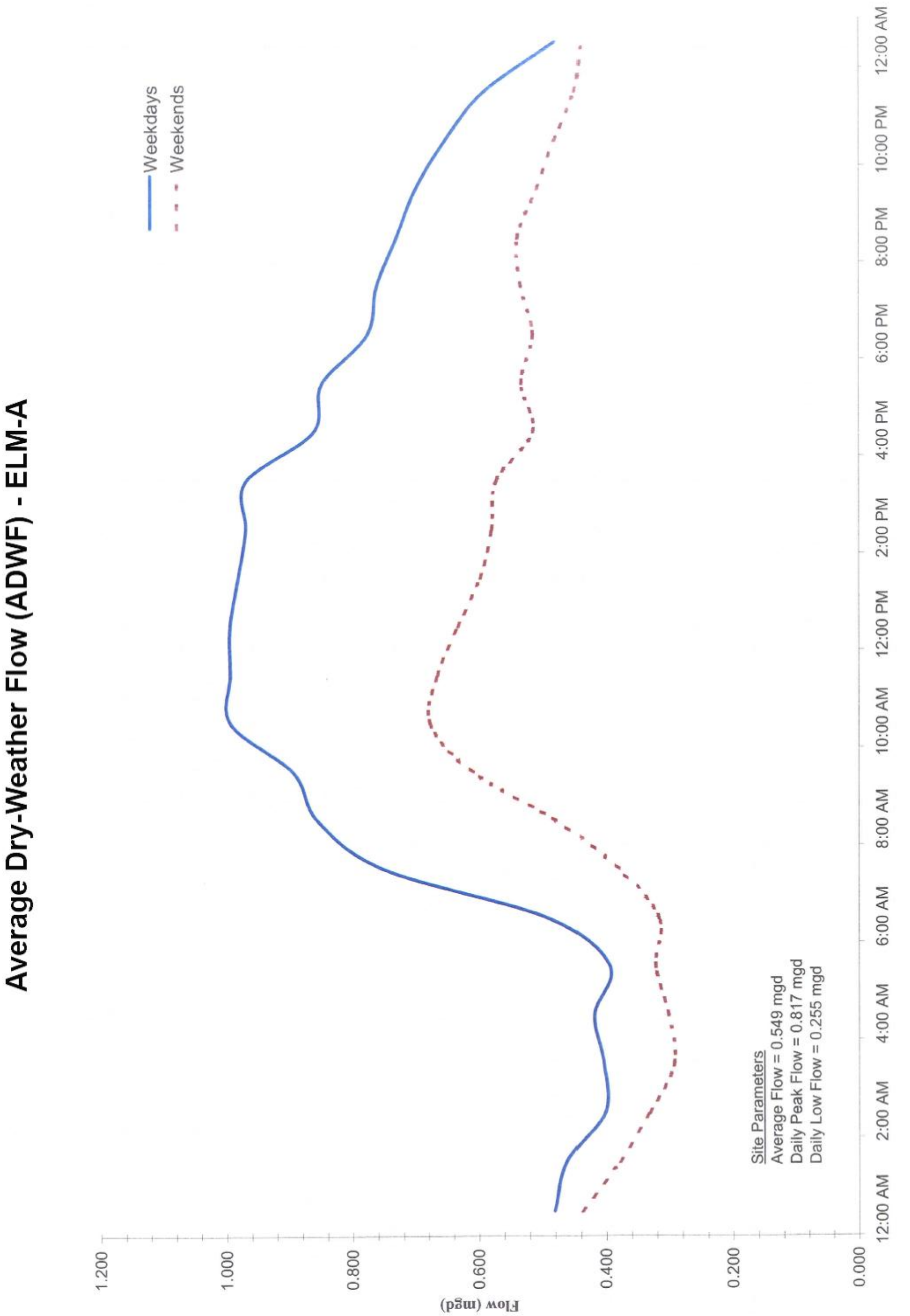

Figure 8.22. Average Dry Weather Flow

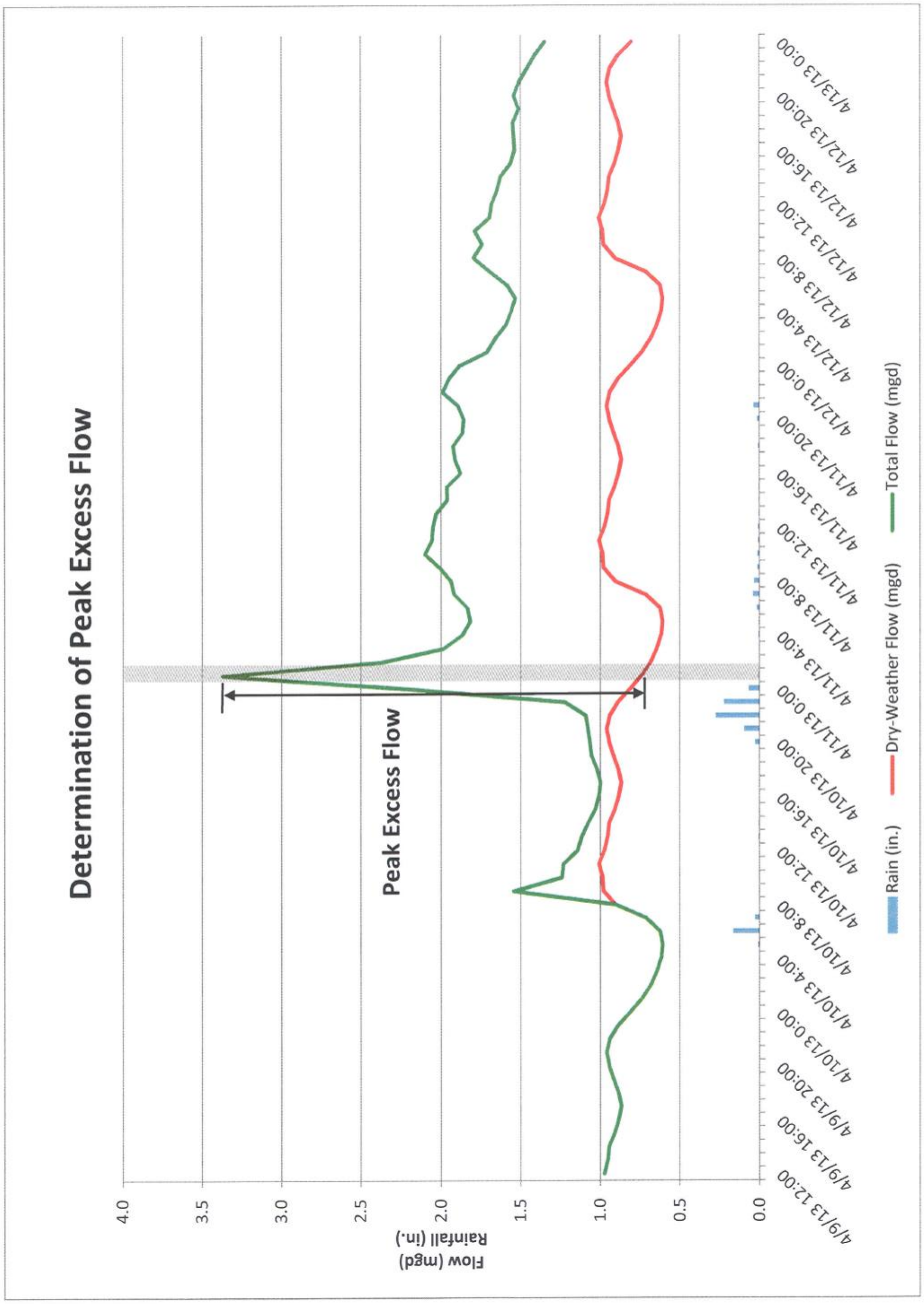

Figure 8.23. Determination of Peak Excess Flow

Typical Basin Ranking- Wet Weather Peaking Factors

Meter	Dry Weather Flow (mgd)	1-Hr Peak Flow (mgd)	Wet Weather Peaking Factor	Priority Ranking
G	0.65	19.5	30.0	1
O	0.60	17.7	29.5	2
Q	0.44	12.2	27.7	3
A	0.42	10.5	25.0	4
D	0.56	13.2	23.5	5
N	0.39	6.0	15.5	6
F	0.69	9.8	14.2	7
R	0.61	8.2	13.5	8
C	0.49	6.1	12.5	9
E	0.59	6.5	11.0	10
F	0.55	5.5	10.0	11
H	0.70	5.6	8.0	12
J	0.62	4.8	7.7	13
B	0.55	4.1	7.5	14
E	0.61	3.1	5.0	15

Figure 8.24. Typical Basin Ranking- Wet Weather Peaking Factors

Local Storage Requirements

In the event that a **satellite entity** has an active sewer **maintenance** program but still experiences **SSOs** and **BBs**, the **satellite entity** may consider constructing local wet weather storage facilities. The purpose of such facilities is to store excessive wet weather flow, which is later released into the **sanitary sewer** system when capacity is available. Wet weather flow that can be kept in a storage facility does not cause **BBs** or **SSOs**. Local storage facilities shall only receive wet weather flow.

Sizing of any wet weather flow facility depends upon the storage volume needed to prevent **BBs** and **SSOs** at the design wet weather event chosen by the **satellite entity**, the conditions and locations of the site of the storage facility, and the budget of the **satellite entity** for the improvement. Permits for local wet weather storage facilities must be obtained from the **District** as well as **IEPA**.

A **satellite entity** that wants to build a local storage facility should request a meeting with the **District** prior to submitting a permit application. At the meeting, the **satellite entity** should provide an analysis demonstrating the impact the local storage facility is predicted to have on reducing **BBs** and **SSOs**. If the portion of the public sewer system tributary to a local storage facility has not been classified as high risk sewer under the Short Term Requirements (prior to submitting a permit application for a local storage facility) the **satellite entity** must submit a written summary of its efforts to reduce I/I in the tributary area. This summary must include a description of public sector inspections and rehabilitation work as well as private sector inspections and corrections or improvements.

If a local storage facility is installed upstream of a lift station, the allowable rate of discharge from the lift station must be based on the dry weather flow generated by the tributary population.

Odor control measures should be considered as part of any local storage facility design. **Satellite entities** must develop a cleanup plan for any local wet weather storage facilities. Provisions for minimizing **groundwater** from flowing into storage facilities must be included in the design of such facilities. Permit application submittals for local storage facilities must include a **maintenance** and cleanup plan.

Once a local wet weather storage facility is constructed, **satellite entities** are cautioned that **SSOs** and **BBs** could still occur, depending upon the severity of wet weather events and the design capacity of the storage facility.

The **District** will consider permit applications for local storage facilities at any time during the IICP. The **District** will review Annual Summary Reports submitted under ICAP to determine whether a **satellite entity** that submits a permit application before implementing their **LTOMP** under the IICP has an active sewer **maintenance** program.

<u>Individual Backflow Prevention</u>

Another mechanism for prevention of **BBs** available to **satellite entities** and their residents is individual backflow prevention. Individual backflow prevention is any measure taken by a property owner to prevent wastewater from backing up through the lateral from the public sewer main. These measures are typically used in situations where the risk of **BBs** is atypically high, and measures to prevent **BBs** by flow reduction or public system capacity improvements is insufficient in mitigating that risk. Some examples of these situations are as follows:

- Locations where the ground profile is low relative to adjacent properties;
- Locations where the grade elevation is low relative to the invert of the public sewer;
- Properties near a lift station where the wet well level can influence the water level in upstream sewers;
- Properties with lateral connections to a large-diameter public main;
- Locations near the confluence of large diameter sewers and/or force main discharges;
- Locations near the connection to a regional interceptor that exerts downstream control on the local public sewer main; and
- Properties amid clusters of properties with large inflow sources, which collectively can overburden a small-diameter public main.

Common backflow prevention measures include the following:

- **Stand pipes and plugs.** Stand pipes and plugs are inexpensive devices inserted into a basement floor drain to prevent backflow of sewage through the drain. These devices are typically effective up to a few feet of head pressure.
- **Backwater valves.** Backwater valves are check valves that can be inserted into the private lateral at relatively low cost and ensure that wastewater can only flow out the lateral and cannot back up from the public main. However, backwater valves cannot assure outflow from the lateral to the public main in a surcharged condition. Schematic illustrations of backwater valve installations are shown in Figures 8.25 and 8.26.
- **Overhead sewer connection.** Overhead sewers are a relatively expensive modification to a property's interior plumbing that pump wastewater from basement facilities to the first floor level, allowing continued use of facilities during a surcharged condition and making a sewer backup extremely unlikely. A typical installation is shown in Figure 8.27.
- **External pump-over.** An external pump-over is an arrangement in which wastewater from the interior of a home flows into an external sump pit on the property and is then pumped into the public sewer main. These devices are very costly and require backup generators to ensure continued operation during power outages. A schematic of an external pump-over system is provided in Figure 8.28.

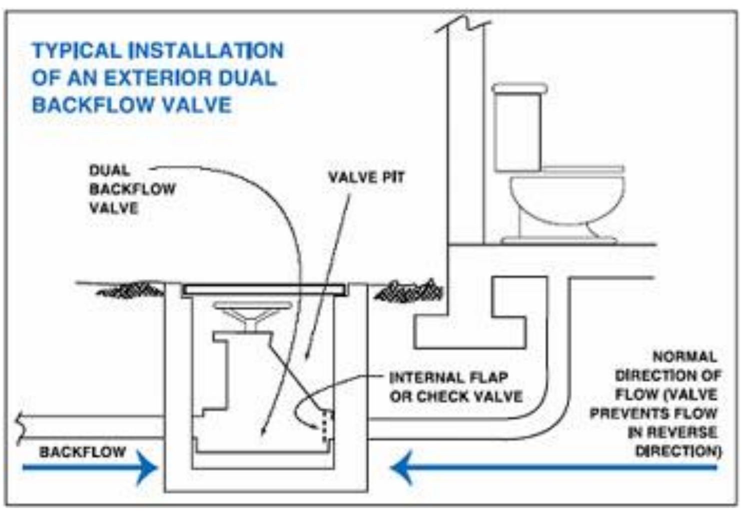

Figure 8.25. External Backflow Prevention Valve System

With any backflow prevention measure where water can be pumped into a public main, it is typical practice to require that the property owner receive a **building** permit from the public entity providing sewer services. Permit requirements help the entity maintain records of where these measures are implemented and provide a means for requiring the disconnection of private sector I/I sources (storm sumps, downspouts, and foundation drains) as a condition of granting the permit.

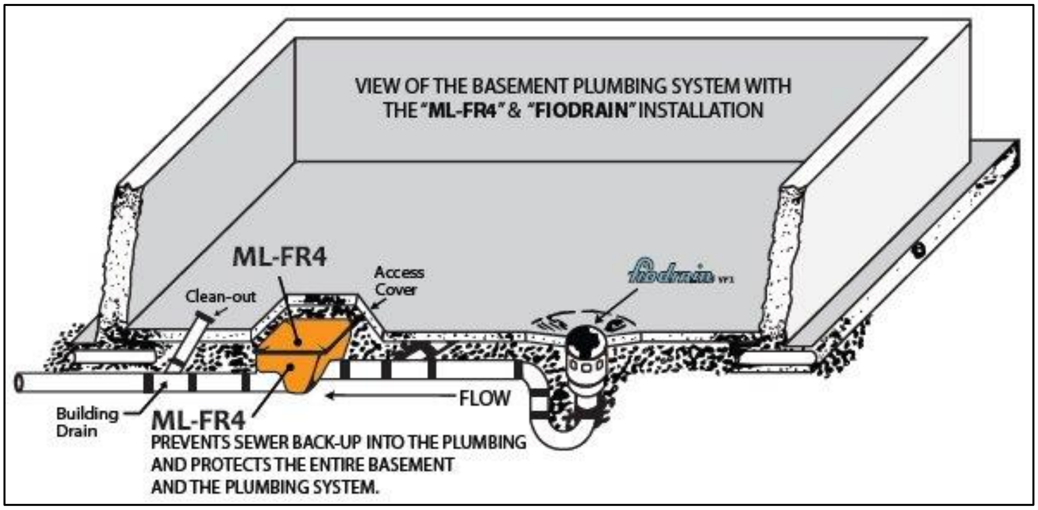

Figure 8.26. Internal Backflow Prevention Valve System

Funding of backflow prevention measures is often shared by the property owner and the public entity providing sewer services. Typical arrangements include cost-sharing programs where public funds are used to pay for a specific percentage of the improvement up to maximum dollar amount or where public funds are used to front the total cost with the property owner gradually paying back through an additional surcharge on monthly sewer service fees.

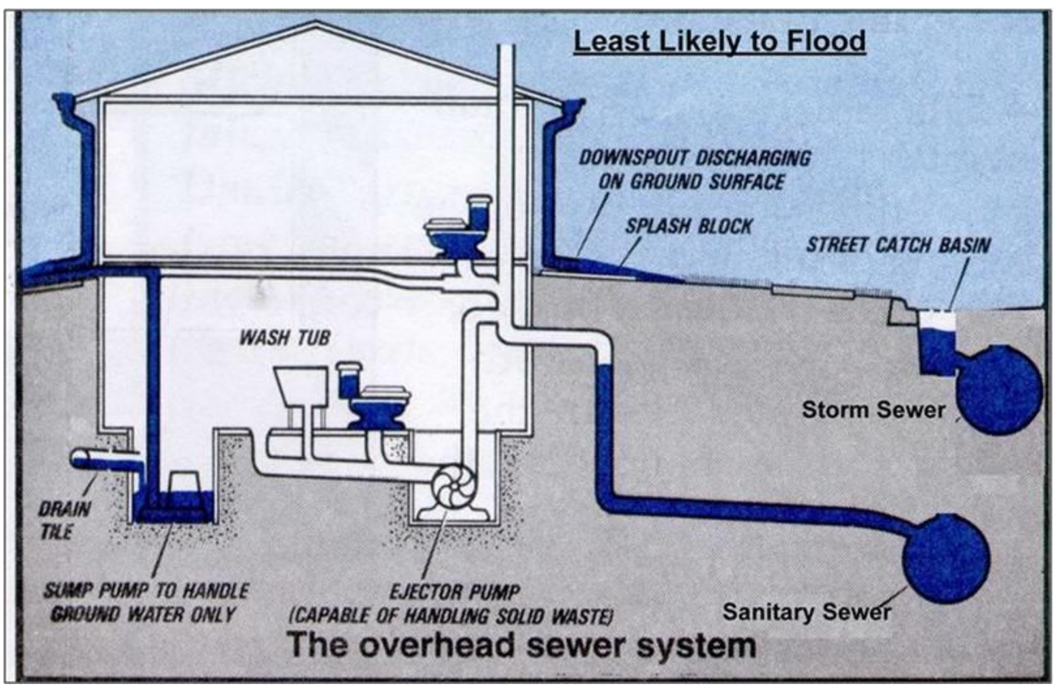

Figure 8.27. Typical Overhead Sewer System

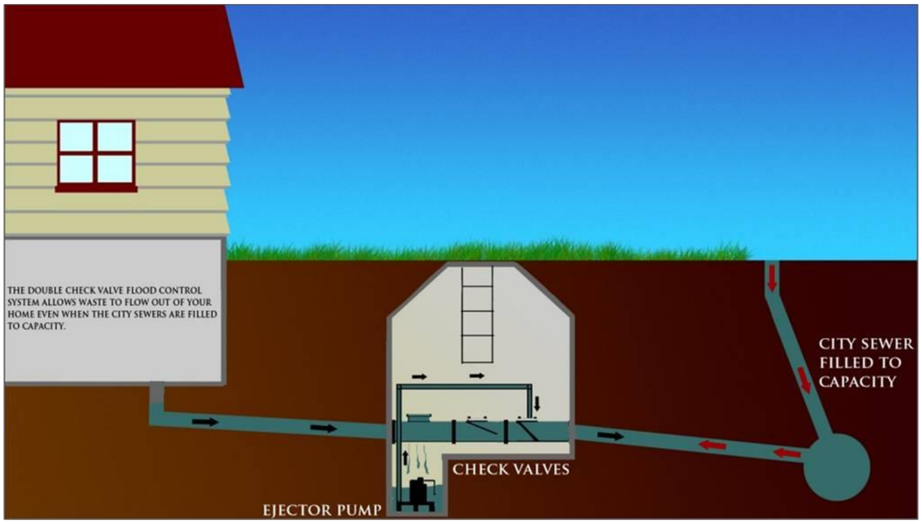

Figure 8.28. External Pump-Over System

FOG Programs

An important component of **sanitary sewer** management in most systems is a proactive, effective program to control the release of fats, oils, and greases (FOG) into the system. Due to the presence of potential contributors of significant amounts of FOG, most **satellite entities** in the **District** should have a FOG program, primarily those having food service establishments (FSEs) and large apartment **buildings**. When FOG cools, it solidifies and adheres to the inside surfaces of sewers and manholes. Over time, FOG builds up and reduces the conveyance capacity of the sewer system. FOG accumulation is a significant cause of **SSOs**, particularly dry weather **SSOs**. Therefore, preventing FOG from entering the **sanitary sewer** system is essential to maintain sewer capacity and keep sewer cleaning costs down. This is accomplished through good practices by sewer users, particularly FSEs, and through installation of grease traps and interceptors. Under the Illinois Plumbing Code, plumbing systems for institutions or commercial establishments in which grease, fats, culinary oils or similar waste products from kitchens or food processing areas are wasted - or in which grease, fats or culinary oils are wasted in connection with utensil, vat, dish or floor cleaning processes - shall include grease interceptors. All waste lines and drains carrying grease, fats or culinary oil in these establishments shall be directed to one or more interceptors. All other waste streams from such **buildings**, including discharge from dishwashing machines, must bypass grease basins or interceptors.

A sample grease interceptor is shown in Figure 8.29. Critical elements of grease interceptors include: the inlet and outlet tees - which extend below the liquid surface, cleanouts on the inlet and outlet tees, the baffle wall - which forces most of the gravity separation of sediments, water, and grease to take place on the inlet side of the basin, a manhole cover which provides access for cleaning the basin, and an opening for water to flow from the inlet side to the outlet side without overtopping the baffle.

As an alternative to grease interceptors that are part of the exterior **sanitary sewer** system, FSEs may install grease traps inside of the **building**, which are usually just above or below the floor.

A FOG program should establish legal authority, and describe the **satellite entity's** requirements for the following:

- Plan review and design standards;
- Inspections;
- Permitting and control mechanisms;
- Enforcement;
- Communication;
- Performance measures;
- Public education; and
- Information management system.

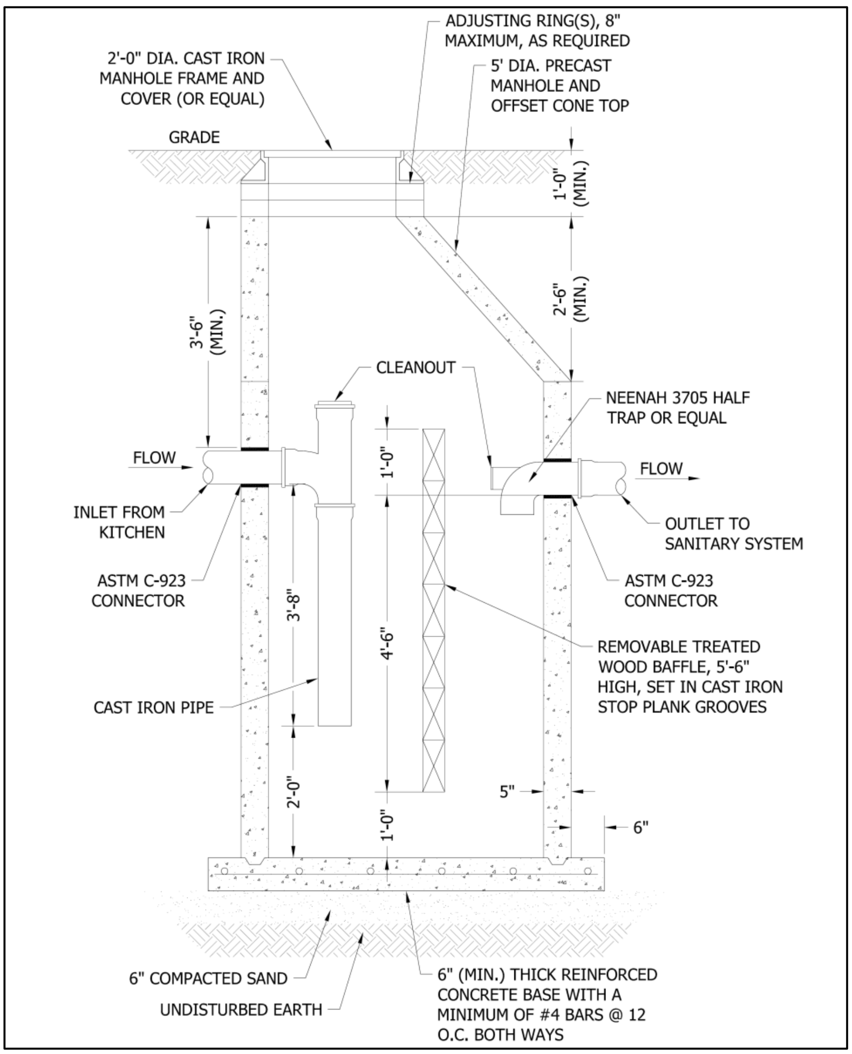

Figure 8.29. Typical Grease Interceptor (Source: Illinois Plumbing Code)

Ongoing public education efforts are necessary to ensure that residents know not to discharge FOG to plumbing fixture drains. The **District** website contains examples of municipal FOG programs.

ANNUAL REPORTING (§806)

Satellite entities must submit Annual Reports to the **District** of their progress and plans relative to their Short Term Requirements and **LTOMP**. Annual Reports must be submitted regardless of the degree of progress made during the reporting period. Depending on the manner in which deficiencies in the **sanitary sewer** system are found and addressed, additional report forms and supporting documents many need to be submitted with the annual reports. All annual reports should reference work completed within the **satellite entities**' **separate sewer area** only. Examples of completed report forms are included in Appendix D.

Annual reports must be submitted to the **District** every March 1st detailing work completed for the preceding calendar year of January 1st to December 31st. To cover the transition from ICAP to the IICP Short Term Requirements, and then to the **LTOMP**, **satellite entities** that were part of the **District** before the effective date of the IICP must submit reports according to the following schedule:

Table 8-7. Schedule for Satellite Entity Annual Reporting

Report Due Date	***Reporting Year***	***Report Form***
March 1, 2015	January 1, 2014-December 31, 2014	ICAP Annual Summary Report
March 1, 2016	January 1, 2015-December 31, 2015	Short Term Requirements Annual Summary Report, Infiltration & Inflow Control Program
Annual reports for 2016-2019 should be made using the Short Term Requirements Annual Summary Report, until the satellite entity has completed the Short Term Requirements, after which the Long Term O&M Program Annual Summary Report Form will be submitted.		
March 1, 2021	January 1, 2020-December 31, 2020	Long Term O&M Program Annual Summary Report, Infiltration & Inflow Control Program

Short Term Requirements Annual Summary Report

First Full Year

The first Short Term Requirements Annual Summary Report must include the following:

1. A completed *Condition Assessment Prioritization Form* as an attachment.
2. A map showing which sewers are high risk and the extent of the areas served by those sewers. This map should also show the full extent of the satellite system's service area. If condition assessment work has occurred during the reporting year, the areas where this work was conducted should also be shown on the map. Only one map needs to be submitted with the Short Term Requirements Annual Summary Report.

3. Documentation showing the location of condition assessment work on High Risk **Sanitary Sewers** performed between July 10, 2009 and July 10, 2014, if the **satellite entity** requests credit for such work. This documentation must demonstrate when the work was performed, and that the work was performed according to NASSCO standards. Documentation showing any High Priority Deficiencies identified during the condition assessment must be submitted.
4. A completed *Sanitary Sewer System Description and Inventory Form*.
5. If High Priority Deficiencies have been identified and have not been corrected during the reporting year, a *Status of High Priority Deficiencies Form* must be submitted with the Short Term Requirements Annual Summary Report.
6. If any High Priority Deficiencies have been identified but not corrected in the reporting year and are to be addressed under the Capital Improvement Plan (CIP), a CIP must be submitted with the Short Term Requirements Annual Report.

<u>Second Year through Fifth Year</u>

Subsequent Short Term Requirements Annual Summary Reports are to be submitted until the **satellite entity** has complied with the Short Term Requirements, which shall occur no later than five years after the effective date of the IICP. These Short Term Requirements Annual Summary Reports must include the following:

- An updated *Status of High Priority Deficiencies Form*;
- An updated CIP; and
- An updated sewer system map showing locations of condition assessment activities performed in the reporting year.

Long Term O&M Program Annual Summary Report

This report is to be submitted to summarize activities occurring in the year the **satellite entity** completes the Short Term Requirements. The **Long Term O&M Program** Annual Summary Reports must include the following:

1. A *Status of High Priority Deficiencies Form*, if High Priority Deficiencies have been identified but not addressed during the reporting period, and/or if High Priority Deficiencies identified in previous years have been addressed in the reporting period.
2. A CIP showing when High Priority Deficiencies will be addressed.
3. A list of property addresses where private sector I/I sources have been identified but not corrected.
4. A schedule for correcting the private sector I/I sources that have been identified but not corrected.

If a **satellite entity** undertakes any substantial sewer system improvements during the reporting period, which includes providing service to areas that were not previously served by the **satellite entity**, or full separation of a **combined sewer area**, then a revised *Sanitary Sewer System*

Description and Inventory Form must be submitted with the **Long Term O&M Program** Annual Summary Report for that year.

Item 4 of the Short Term Requirements Annual Summary Report and Item I of the **Long Term O&M Program** Annual Summary Report require summary information about **SSOs** and **BBs**. Only reportable events should be included in the total numbers of occurrences of **SSOs** and **BBs**. Reportable events include wet weather **SSOs**, dry weather **SSOs** and **BBs** caused by public sewer surcharging and blockages under either wet weather or dry weather conditions. Reportable events do not include **BBs** caused by collapse or blockage entirely of the private service lateral.

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