City of Bayport

# Illicit Discharge Detection and Elimination Program

Minimum Control Measure 3

Standard Operating Procedures

May 2020

# Bayport Illicit Discharge Detection and Elimination (IDDE) Program

**Table of Contents:**

# 1. Introduction

The purpose of the IDDE program is to detect and eliminate sources of pollution to the municipal separate storm sewer system (MS4) as required by the National Pollutant Discharge Elimination System/State Disposal System (NPDES/SDS) permit program, permit number: MNR40000. The primary goal of this plan is to identify and then eliminate illicit discharges. Examples of illicit discharges include:

- Direct or indirect sanitary wastewater discharges that connect to the storm sewer or watercourse, such as a floor drain connected to a storm drain, a cross-connection between the municipal sewer and storm sewer systems, a damaged sanitary sewer line that is leaking sewage into a cracked storm sewer line, or a failing septic system that is leaking into a water course.
- Materials (e.g., used motor oil) that have been dumped illegally into a storm drain catch basin or other stormwater facility.
- Improper home or business owner activities such as washing paint brushes into a catch basin, washing new textured concrete driveways into a storm drain, draining swimming pools to the storm system (swimming pools have high pH and chlorine), excess use of fertilizers, or washing cars with chemicals that enter the storm drain system.
- Sediment and sediment-laden runoff from construction sites entering the storm drainage system.

Additional goals of the IDDE program include:

- Improve water-quality in local waterways by reducing incidences of pollution to the MS4.
- Increase awareness among municipal employees, businesses, and the general public of the direct connection between the MS4 and local waterways.
- Educate municipal employees, businesses, and the general public of the hazards associated with illicit discharges and the best management practices (BMPs) available.
- Facilitate consistency in response to incidences of discharges of pollutants to City's stormwater system through a coordinated system of procedures and training of municipal employees.

The NPDES permit sets forth the minimum elements of the plan, which are listed below. These minimum elements are described throughout the remainder of this document.

- Municipal storm sewer system mapping (Part III.D.3.a)
- Ordinances (that effectively prohibit illicit discharges) (Part III. D.3.b)
- Incorporating IDDE into maintenance and inspection activities (Part III.D.3.c)
- Visual IDDE inspections (Part III.D.3d)
- Staff training (Part III.D.3e)
- Locating priority areas (Part III.D.3.f) 4
- Response procedures (Part III.D.3.g)
- Incident reporting (Part III.D.3.h)

# 2. Municipal Storm System Mapping

The NPDES Phase II permit outlines minimum information that should be included in the City's municipal storm sewer system map:

- Location of all known municipal storm sewer conveyances 12" or greater in diameter, including the stormwater flow direction in the pipes.
- Outfalls, including a unique identification (ID) number assigned by the City, and an associated geographic number.
- Structural stormwater BMPs that are part of the City's small MS4.
- All receiving waters.

The City has completed GIS mapping of the city's stormwater system, including all basins, pipes, ditches, and stormwater facilities, and all outfalls, structural BMPs, ponds, and wetlands identification with unique ID numbers. The City shall update the storm sewer system map annually, and the map shall be used to schedule and track maintenance activities, as well as plan for capital improvement projects.

## 3. Regulatory Mechanism: City Ordinance

Section 58-146 through 147 of the Bayport City Code of Ordinances prohibits illicit discharges. Connections to the stormwater system must contain only stormwater and groundwater, otherwise they are to be eliminated. References to the fines and penalties that can be levied against violators can be found in Section 25-1 through 14. The IDDE ordinance is included in Appendix D for reference.

## 4. Incorporating IDDE into Maintenance and Inspection Activities

Potential illicit discharge problems can be revealed through outfall inspections or reports from staff, tenants, or the public, as described in Section 5. When a complaint is reported, the Phase II permit requires that a follow-up investigation be initiated within seven (7) days, on average. The follow-up investigation could include a site visit to look at the problem area, review of mapping information, review of past complaints or investigations at the location, or other data collection and review. Once a problem has been verified (either through a routine outfall inspection or follow-up to a complaint) the City will begin an official illicit discharge investigation, following the procedures outlined in this Section 5.

When an illegal dumping or illicit discharge problem is directly observed by a member of City staff, it is generally not necessary to follow these investigation procedures. In this scenario, the source of the problem discharge is already known. Problems revealed through direct observation are referred directly to the corrective action information in Section 8. In the event that a reported problem does not have a defined source, the procedures in Section 5 should be followed to trace the source of the illicit discharge.

## 5. Visual Illicit Discharge Detection Inspection Procedures

### 5.1. Tracking the Source

Source tracking begins when an illicit discharge is identified through outfall inspections, field assessment/testing, or a report from City staff or resident. When an illegal dumping or the source of an illicit discharge is directly observed by City staff, no investigation is necessary and corrective actions outlined in Section 8 shall be implemented. When the source of the non-stormwater discharge is unknown, one of two primary visual inspection methods shall be used to locate the source of the illicit discharge:

- Method A – Storm drain network investigations
- Method B – Drainage area investigations

The method used will depend on the type of information collected or reported, level of understanding of the drainage network, and existing knowledge of operations and activities on the surrounding properties. All source tracing investigations should be documented and recorded.

#### 5.1.1. Documentation

When discharges are identified, a report is created listing the property name, person responsible, and tracking all information related to the observed or suspected problem. This becomes the City’s official record of the IDDE investigation. Additional record keeping information is included in Section 8. The investigator assigned to the case shall keep an accurate log of labor, materials, and costs associated with the investigation for invoicing the responsible party. The report should be started prior to completing any additional field work

unless the nature of the discharge necessitates immediate response. In addition to filling out the report, the file should include copies of the following, if applicable:

- GIS inspection map
- Photographs
- Field notes
- Lab testing results
- Compliance letters sent and responses received
- Correspondence (mail, email, telephone logs)
- Proof of corrected discharge (contract/invoice/clean field investigation report)

5.1.2. Method A – Storm Drain Network Investigations

The source of some illicit connections or discharges can be located by systematically isolating the area from which the polluted discharge originates. This method involves progressive investigation at manholes in the storm drain network to narrow down the location where the illegal discharge is entering the drainage system. This method is best used to identify constant or frequent discharge sources such as an illicit connection from a sewer system or sink drain into the storm drainage network. One-time illegal discharges (such as a surface spill or intentional dumping into the storm drain system) should be investigated using Method B described later in this section.

Field crews should work progressively upstream from the outfall and inspect manholes until indicators reveal the discharge is no longer present. Manhole observations can be time consuming, but they are generally a necessary step before conducting other tests. Particularly for large storm drain systems, it may be helpful to first identify major branches of the system and test one manhole at the downstream end of each branch. This can help to reduce the area that must be investigated.

Storm drain network investigations include the following steps:

1. Consult the drainage system map and identify major branches and drainage patterns.
2. Consult outfall inspection records and previous IDDE reports for any background information that may be relevant to the current investigation.
3. Investigate manholes identified from the storm system map for evidence of illicit discharge and determine branch containing source.
4. Once the branch of the network is identified, progressively investigate upstream until evidence of discharge is found or no longer present.
5. Work downstream from the “clean” manhole to the last known polluted manhole to isolate the location where the polluted discharge is entering the storm drain system.
6. If discharge is evident from private property, initiate private property site entry procedures.
7. Document all findings in field notes and inspection report and coordinate response procedures. All procedures and findings shall be documented using the IDDE Report and Response from located in Appendix A.

When visual inspections are not enough to isolate the source of the illegal discharge, a number of additional field tests can be performed, including dye testing, video testing/televising, and smoke testing. *The Center for Watershed Protection’s Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments* (Pitt et

al., 2004) provides instructions for employing these testing techniques. The relevant pages from that manual are included in Appendix C.

5.1.3. Method B – Drainage Area Investigation

The source of some illegal discharges can be determined through a survey or analysis of the drainage area of the problem outfall. Drainage area investigations are particularly useful when the discharge observed at the outfall has a distinct or unique characteristic that can allows field crews to quickly determine the type of activity or non-point source that is generating the discharge. However, drainage area investigations are generally not helpful in tracking sewage discharges, since they are not related to a specific land use.

Drainage area investigations should begin with a discussion between the field crews, inspectors, engineers, and other knowledgeable City staff to identify the type of site most likely to produce the observed discharge. Table 5-1 shows some of the activities or land uses most likely associated with specific discharge problems.

**Table 5-1**
**Common Discharges and Potential Sources**

| **Observed Discharge** | **Potential Causes** |
|---|---|
| Clogging sediment | • Construction activity without proper erosion and sediment controls<br>• Roadway sanding operations<br>• Outdoor work areas or material storage areas |
| Thick algae growth | • Fertilizer leak or spill<br>• Landscaping operations<br>• Hydroseeding following construction<br>• Failing or leaking septic system |
| Oil | • Refueling operations<br>• Vehicle or machinery maintenance activities |
| Sudsy discharge | • Power washing of buildings<br>• Vehicle or equipment washing operations<br>• Mobile cleaning crew dumping<br>• Laundry or cleaner<br>• Household greywater discharge |
| Clogged grease | • Restaurant sink drain connection to stormwater system |
| Sewage | • Failing or leaking septic systems |

5.1.4. Equipment

Prior to conducting investigations, field staff shall assemble the equipment necessary. Table 5-2 lists common equipment needed for illicit discharge investigations.

| **Table 5-2: Field Equipment for Illicit Discharge Investigations** | |
|---|---|
| Field notebook/pencils | Watch with second hand |
| Safety gear – vest, work boots, cones | Flash light or head lamp |
| Map/GIS map/aerial photo of inspection area | Tool box – hammer, tape measure, duct tape, zip ties |
| Cell phone w/ charged battery | First aid kit |
| Digital camera w/ charged battery | Clear sample bottles |

### 5.2. Follow-Up Actions

Once the source of an illicit discharge has been identified, the investigator should notify the property owner or operator of the problem and provide the appropriate educational materials and/or a notice of violation. This is an important first step in the corrective action process. The investigator completes the response procedures to document the findings. The investigator can then begin working through the corrective action steps outlined in Section 8.

## 6. Visual Illicit Discharge Detection Inspection Procedures

The City has developed a training schedule to meet the requirements of the NPDES Phase II permit and two primary trainings have been identified related to IDDE:

- Training for all staff that are routinely in the field to educate them on what constitutes an illicit discharge problem and how to report suspected problems.
- Training for illicit discharge responders on proper identification, investigation, clean-up, disposal, and reporting techniques for illicit discharges.

These trainings shall be generally conducted using materials developed for the IDDE program. Training shall include Power Point presentations, webcast material, and printed material distributed at staff meetings. The SWPPP, BMPs, and goals outline education and training to be implemented by the City.

## 7. Identification of Priority Areas

Identification of priority areas likely to have illicit discharges, including at a minimum, evaluating land uses associated with business/industrial activities, areas where illicit discharges have been identified in the past, and areas with storage of large quantities of significant materials that could result in an illicit discharge. Based on this evaluation, the permittee shall conduct additional illicit discharge inspections in those areas identified as having a higher likelihood for illicit discharges.

### 7.1. Developing Priority Areas

Identifying priority areas is vital to the development of an IDDE program. This process can be broken down into three fundamental steps:

1. Collect and study of all available information regarding land uses, material storage areas, and prior illicit discharges.
2. Performance of dry weather field screenings for non-stormwater discharges.
3. Review of water quality sampling and analysis for non-stormwater discharges.

### 7.2. Locating Priority Areas

The first step in locating priority areas is to identify areas that have a high potential for illicit discharges within the community. These can be broken down into a list of commonly high probability locations where illicit discharges may be or are likely to occur:

1. Locations where there have been repeated problems in the past. This includes locations with known water quality data, as well as locations where numerous complaints have been received. These areas should be known by community officials as well as other agencies that collaborate on specific problem areas.
2. Using existing information to assess where illicit discharges may be found and what waterbodies are particularly sensitive (e.g. drinking water sources, areas containing unique biodiversity, and swimming areas).
3. Older areas of a community may indicate possible locations where there will be illicit discharges detected. These locations may have a higher percentage of illegal connections and/or have deteriorating sewer lines leading to infiltration problems from the older infrastructure found in that area.

4. The commercial and/or industrial areas of the community will tend to have a higher percentage of illicit discharges.
5. Areas where large quantities of materials are stored (e.g. stockpiles, vessels containing hazardous solids or liquids, etc.).
6. High potential land uses for discharge (e.g. restaurants, dumpsters, car washes, mechanics, and oil change facilities).

Using the guidelines provided above, the City has identified industrial and commercial properties as priority areas within the city limits. Staff is encouraged to use the Minnesota Pollution Control Agency's online search tool "What's in My Neighborhood" to locate businesses that have the potential to discharge contaminated pollutants to the environment within the City limits.

## 8. Response Procedures

Illicit discharges can be revealed through routine inspections, maintenance, or reports from City staff and/or residents. If the discharge requires immediate action, immediate response procedures in this section shall be implemented. If the discharge does not require immediate action, an investigation shall be initiated within three (3) days. Refer to Section 5 for visual inspection procedures.

### 8.1. Immediate Response Procedures

Field personnel should be prepared to take immediate action in the event of encountering one of the following situations:

- Individuals actively in the process of introducing possible illegal substances or materials to the storm drain system.
- Very strong chemical odor, or presence of fumes or smoke emanating from storm drain system.
- Visible significant stream of a controlled chemical or petroleum product flowing in storm system or downstream waters.
- Large chemical plume in stream or river downstream of a City outfall.
- Any condition that poses or could pose an immediate threat to property, human health or safety, or aquatic life.

Field personnel should take the following steps if one of the above situations is encountered:

- Ensure public safety by instructing people to stay clear of the area.
- **Call 911 to report a major spill, active illegal dumping, or potential fire incident.**
- The following offices must be called if an unauthorized discharge of oil or hazardous material that qualifies as a spill has occurred:
    a. Non-emergency police dispatch (651-439-9381)
    b. Minnesota duty officer (651-649-5451)
    c. Middle St. Croix Water Management Organization (651-330-8220 Ext. 22)
- If a spill is encountered, the following information should be recorded:
    a. Where is the spill?
    b. What spilled?
    c. How much spilled?
    d. How concentrated is the spilled material?
    e. Who spilled the material?
    f. Is anyone cleaning up the spill?
    g. Are there resource damages (e.g. dead fish or oiled birds)?
    h. Who is reporting the spill?
    i. What is the contact information for spill reporter?

j. Any notes, photos, and video that can be used for subsequent investigation.

- If possible isolate or contain visible chemical pollution in the effected waterbody with any materials that are accessible. For small discharges, earth dams, absorbent pads, and containers may be useful to contain part of the illicit discharge.
- Follow-up work includes contacting the Minnesota Pollution Control Agency (651-296-6300) to determine if any additional reporting or investigative actions are necessary.

### 8.2. Corrective Action

#### 8.2.1. Purpose

The City will respond to identified illicit discharges, illicit connections, or illegal dumping activities using progressive enforcement actions. Corrective actions will focus first on education to promote voluntary compliance and escalate to increasingly severe enforcement actions if voluntary compliance is not obtained.

#### 8.2.2. Voluntary Compliance

The preferred approach to address illicit discharge problems is to pursue voluntary compliance through property owner or responsible party education. Often, business operators and property owners are not aware of the existence of illicit connections or activities on their properties that may constitute an illegal discharge. In these cases, providing the responsible party with information about the connection or operation, the environmental consequences, and suggestions on how to remedy the problem may be enough to secure voluntary compliance.

Education begins during the site investigation when the operation or connection is first confirmed. Property owners and operators should be notified that the problems must be corrected in a timely manner and that the City will be conducting a follow-up site visit(s) to verify compliance. Field staff should also provide the property operator with an educational brochure describing illicit discharge violations and a copy of the applicable City ordinance. Field staff should also remind property owners of their obligation to report discharges to the proper agencies.

#### 8.2.3. Operational Problems

Property owners are responsible for correcting operational problems that are leading to illegal discharges to the storm drainage system. This could include moving washing activities indoor or undercover, covering material storage areas, locating an appropriate discharge location for liquid wastes, or other operational modifications. Through site visits and education, the City can provide technical assistance to aid property owners in identifying the required modifications.

#### 8.2.4. Structural Problems

Most illicit connection problems will require a structural modification to correct the problem. Structural repairs can be used to redirect discharges such as sewage, industrial, and commercial cross-connections. Such cross-connections must be re-routed to an approved sanitary sewer system. Correcting structural problems is the responsibility of the property owner, though the City may provide technical assistance throughout the process.

## 9. Incident Reporting

### 9.1. Purpose

Illicit discharges and connections are identified through citizen reporting, interdepartmental or interagency referral, or other routine MS4 inspection activities. The City relies on local citizens, field personnel, and inspections to detect potential problem areas quickly, so that they can be addressed before they cause significant water quality degradation.

9.2. Incident Reporting/Documentation

Field personnel shall be observant in their daily routines to watch for evidence of illicit discharges or unusual flows from the storm drain systems. Should a suspected discharge be discovered, employees must report the incident to the Bayport Public Works Director (651-275-4410).

When a suspected illicit discharge is observed by a concerned citizen, they may elect to fill out a City Stormwater IDDE Report & Response Form (Appendix A). At a minimum, the observer should provide the following information to the MS4 manager:

- Location
- Date
- Time
- License plate number (if applicable)
- Photos

Once this information is submitted to the Public Works Director, a field investigation of the discharge shall occur. The employee initially observing the suspect discharge need not approach the potential violator at the time of the incident. However, if the violator does not appear threatening, personal information for the Illicit Discharge Reporting & Tracking Form would be beneficial.

Once recorded, incident information is referred to the appropriate City department and/or staff person for follow-up. In most cases, IDDE problems should be referred to the Public Works Director for further investigation. Staff will either follow the investigation procedures in Section 5 to identify the source of the problem or, if the source is known, the corrective action procedures outlined in Section 8 will apply.

Appendix A
Stormwater IDDE Report and Response Form

# Stormwater IDDE Report & Response Form

**I. Incident Report** Incident Number:_____

Date/Time: _____AM / PM Received By: _____

Location: _____

Initial Report of Conditions: _____

_____

Reported By: _____ Phone: _____

**II. Investigation**

Date: _____ By: _____

Location Description/Storm Drain ID/Outfall: _____

Discharge Entered Storm Drain System/Receiving Waters? ___Yes ___No

Material Type

- ☐ Hazardous
- ☐ Sediment
- ☐ Wastewater
- ☐ Oil/Grease
- ☐ Other_____
- ☐ Unknown

Est. Quantity: _____

Additional Information: _____

Sample(s) Collected: ____ Yes _____No Photo(s) Taken: ____ Yes _____No

Observed Land Use

- ☐ Residential
- ☐ Commercial/Industrial Stormwater Permit ___Yes ___No ___Unknown
- ☐ Public

Direct/Constructed Connections Found? ___ Yes ___ No

Source Description: _____

Source/Responsible Party: _____

**III. Action and Closure**

Referred To: _____ Date: _____

Action Taken: _____

_____

Date Closed: _____

Appendix B
Enforcement Response Procedures (ERPs)

(See Chapter in SWPPP)

APPENDIX C

Dye Testing, Video Testing/Televising & Smoke Testing

Excerpts from The Center for Watershed Protection's:

Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments

| Table 56: Techniques to Locate the Discharge | | |
|---|---|---|
| **Technique** | **Best Applications** | **Limitations** |
| Dye Testing | • Discharge limited to a very small drainage area (<10 properties is ideal)<br>• Discharge probably caused by a connection from an individual property<br>• Commercial or industrial land use | • May be difficult to gain access to some properties |
| Video Testing | • Continuous discharges<br>• Discharge limited to a single pipe segment<br>• Communities who own equipment for other investigations | • Relatively expensive equipment<br>• Cannot capture non-flowing discharges<br>• Often cannot capture discharges from pipes submerged in the storm drain |
| Smoke Testing | • Cross-connection with the sanitary sewer<br>• Identifying other underground sources (e.g., leaking storage techniques) caused by damage to the storm drain | • Poor notification to public can cause alarm<br>• Cannot detect all illicit discharges |

**TIP**

The Wayne County Department of the Environment provides excellent training materials on on-site investigations, as well as other illicit discharge techniques. More information about this training can be accessed from their website: http://www.wcdoe.org/Watershed/Programs___Srvcs_/IDEP/idep.htm.

**Figure 63: Dye Testing Plumbing (NEIWPCC, 2003)**

## *Dye Testing*

Dye testing is an excellent indicator of illicit connections and is conducted by introducing non-toxic dye into toilets, sinks, shop drains and other plumbing fixtures (see Figure 63). The discovery of dye in the storm drain, rather than the sanitary sewer, conclusively determines that the illicit connection exists.

Before commencing dye tests, crews should review storm drain and sewer maps to identify lateral sewer connections and how they can be accessed. In addition, property owners must be notified to obtain entry permission. For industrial or commercial properties, crews should carry a letter to document their legal authority to gain access to the property. If time permits, the letter can be sent in advance of the dye testing. For residential properties, communication can be more challenging. Unlike commercial properties, crews are not guaranteed access to homes, and should call ahead to ensure that the owner will be home on the day of testing.

Communication with other local agencies is also important since any dye released to the storm drain could be mistaken for a spill or pollution episode. To avoid a costly and embarrassing response to a false alarm,

crews should contact key spill response agencies using a "quick fax" that describes when and where dye testing is occurring (Tuomari and Thomson, 2002). In addition, crews should carry a list of phone numbers to call spill response agencies in the event dye is released to a stream.

At least two staff are needed to conduct dye tests – one to flush dye down the plumbing fixtures and one to look for dye in the downstream manhole(s). In some cases, three staff may be preferred, with two staff entering the private residence or building for both safety and liability purposes.

The basic equipment to conduct dye tests is listed in Table 57 and is not highly specialized. Often, the key choice is the type of dye to use for testing. Several options are profiled in Table 58. In most cases, liquid dye is used, although solid dye tablets can also be placed in a mesh bag and lowered into the manhole on a rope (Figure 64). If a

**Table 57: Key Field Equipment for Dye Testing**
*(Source: Wayne County, MI, 2000)*

**Maps, Documents**
- Sewer and storm drain maps (sufficient detail to locate manholes)
- Site plan and building diagram
- Letter describing the investigation
- Identification (e.g., badge or ID card)
- Educational materials (to supplement pollution prevention efforts)
- List of agencies to contact if the dye discharges to a stream.
- Name of contact at the facility

**Equipment to Find and Lift the Manhole Safely (small manhole often in a lawn)**
- Probe
- Metal detector
- Crow bar
- Safety equipment (hard hats, eye protection, gloves, safety vests, steel-toed boots, traffic control equipment, protective clothing, gas monitor)

**Equipment for Actual Dye Testing and Communications**
- 2-way radio
- Dye (liquid or "test strips")
- High powered lamps or flashlights
- Water hoses
- Camera

**Figure 64: Dye in a mesh bag is placed into an upstream manhole (left); Dye observed at a downstream manhole traces the path of the storm drain (right)**

longer pipe network is being tested, and dye is not expected to appear for several hours, charcoal packets can be used to detect the dye (GCHD, 2002). Charcoal packets can be secured and left in place for a week or two, and then analyzed for the presence of dye. Instructions for using charcoal packets in dye testing can be accessed at the following website: http://bayinfo.tamug.tamu.edu/gbeppubs/ms4.pdf.

The basic drill for dye tests consists of three simple steps. First, flush or wash dye down the drain, fixture or manhole. Second, pop open downgradient sanitary sewer manholes and check to see if any dye appears. If none is detected in the sewer manhole after an hour or so, check downgradient storm drain manholes or outfalls for the presence of dye. Although dye testing is fairly straightforward, some tips to make testing go more smoothly are offered in Table 59.

**Table 58: Dye Testing Options**

| Product | Applications |
|---|---|
| Dye Tablets | • Compressed powder, useful for releasing dye over time<br>• Less messy than powder form<br>• Easy to handle, no mess, quick dissolve<br>• Flow mapping and tracing in storm and sewer drains<br>• Plumbing system tracing<br>• Septic system analysis<br>• Leak detection |
| Liquid Concentrate | • Very concentrated, disperses quickly<br>• Works well in all volumes of flow<br>• Recommended when metering of input is required<br>• Flow mapping and tracing in storm and sewer drains<br>• Plumbing system tracing<br>• Septic system analysis<br>• Leak detection |
| Dye Strips | • Similar to liquid but less messy |
| Powder | • Can be very messy and must dissolve in liquid to reach full potential<br>• Recommended for very small applications or for very large applications where liquid is undesirable<br>• Leak detection |
| Dye Wax Cakes | • Recommended for moderate-sized bodies of water<br>• Flow mapping and tracing in storm and sewer drains |
| Dye Wax Donuts | • Recommended for large sized bodies of water (lakes, rivers, ponds)<br>• Flow mapping and tracing in storm and sewer drains<br>• Leak detection |

**Table 59: Tips for Successful Dye Testing**
*(Adapted from Tuomari and Thompson, 2002)*

**Dye Selection**
- Green and liquid dyes are the easiest to see.
- Dye test strips can be a good alternative for residential or some commercial applications. (Liquid can leave a permanent stain).
- Check the sanitary sewer before using dyes to get a "base color." In some cases, (e.g., a print shop with a permitted discharge to the sanitary sewer), the sewage may have an existing color that would mask a dye.
- Choose two dye colors, and alternate between them when testing multiple fixtures.

**Selecting Fixtures to Test**
- Check the plumbing plan for the site to isolate fixtures that are separately connected.
- For industrial facilities, check most floor drains (these are often misdirected).
- For plumbing fixtures, test a representative fixture (e.g., a bathroom sink).
- Test some locations separately (e.g., washing machines and floor drains), which may be misdirected.
- If conducting dye investigations on multiple floors, start from the basement and work your way up.
- At all fixtures, make sure to flush with plenty of water to ensure that the dye moves through the system.

**Selecting a Sewer Manhole for Observations**
- Pick the closest manhole possible to make observations (typically a sewer lateral).
- If this is not possible, choose the nearest downstream manhole.

**Communications Between Crew Members**
- The individual conducting the dye testing calls in to the field person to report the color dye used, and when it is dropped into the system.
- The field person then calls back when dye is observed in the manhole.
- If dye is not observed (e.g., after two separate flushes have occurred), dye testing is halted until the dye appears.

**Locating Missing Dye**
- The investigation is not complete until the dye is found. Some reasons for dye not appearing include:
- The building is actually hooked up to a septic system.
- The sewer line is clogged.
- There is a leak in the sewer line or lateral pipe.

## *Video Testing*

Video testing works by guiding a mobile video camera through the storm drain pipe to locate the actual connection producing an illicit discharge. Video testing shows flows and leaks within the pipe that may indicate an illicit discharge, and can show cracks and other pipe damage that enable sewage or contaminated water to flow into the storm drain pipe.

Video testing is useful when access to properties is constrained, such as residential neighborhoods. Video testing can also be expensive, unless the community already owns and uses the equipment for sewer inspections. This technique will not detect all types of discharges, particularly when the illicit connection is not flowing at the time of the video survey.

Different types of video camera equipment are used, depending on the diameter and condition of the storm sewer being tested.

Field crews should review storm drain maps, and preferably visit the site before selecting the video equipment for the test. A field visit helps determine the camera size needed to fit into the pipe, and if the storm drain has standing water.

In addition to standard safety equipment required for all manhole inspections, video testing requires a Closed-Circuit Television (CCTV) and supporting items. Many commercially available camera systems are specifically adapted to televise storm sewers, ranging from large truck or van-mounted systems to much smaller portable cameras. Cameras can be self-propelled or towed. Some specifications to look for include:

- The camera should be capable of radial view for inspection of the top, bottom, and sides of the pipe and for looking up lateral connections.
- The camera should be color.
- Lighting should be supplied by a lamp on the camera that can light the entire periphery of the pipe.

When inspecting the storm sewer, the CCTV is oriented to keep the lens as close as possible to the center of the pipe. The camera can be self-propelled through the pipe using a tractor or crawler unit or it may be towed through on a skid unit (see Figures 65 and 66). If the storm drain has ponded water, the camera should be attached to a raft, which floats through the storm sewer from one manhole to the next. To see details of the sewer, the camera and lights should be able to swivel both horizontally and vertically. A video record of the inspection should be made for future reference and repairs (see Figure 67).


**Figure 65: Camera being towed**

## Smoke Testing

Smoke testing is another "bottom up" approach to isolate illicit discharges. It works by introducing smoke into the storm drain system and observing where the smoke surfaces. The use of smoke testing to detect illicit discharges is a relatively new application, although many communities have used it to check for infiltration and inflow into their sanitary sewer network. Smoke testing can find improper

**Figure 66: Tractor-mounted camera**

**Figure 67: Review of an inspection video**

connections, or damage to the storm drain system (Figure 68). This technique works best when the discharge is confined to the upper reaches of the storm drain network, where pipe diameters are to small for video testing and gaining access to multiple properties renders dye testing infeasible.

Notifying the public about the date and purpose of smoke testing before starting is critical. The smoke used is non-toxic, but can cause respiratory irritation, which can be a problem for some residents. Residents should be notified at least two weeks prior to testing, and should be provided the following information (Hurco Technologies, Inc., 2003):

- Date testing will occur
- Reason for smoke testing
- Precautions they can take to prevent smoke from entering their homes or businesses
- What they need to do if smoke enters their home or business, and any health concerns associated with the smoke
- A number residents can call to relay any particular health concerns (e.g., chronic respiratory problems)

Program managers should also notify local media to get the word out if extensive smoke testing is planned (e.g., television, newspaper, and radio). On the actual day of testing, local fire, police departments and 911 call centers should be notified to handle any calls from the public (Hurco Technologies, Inc., 2003).

The basic equipment needed for smoke testing includes manhole safety equipment, a smoke source, smoke blower, and sewer plugs. Two smoke sources can be used for smoke testing. The first is a smoke "bomb," or "candle" that burns at a controlled rate and releases very white smoke visible at relatively low concentrations (Figure 69). Smoke bombs are suspended beneath a blower in a manhole. Candles are available in 30 second to three minute sizes. Once opened, smoke bombs should be kept in a dry location and should be used within one year.

The second smoke source is liquid smoke, which is a petroleum-based product that is injected into the hot exhaust of a blower where it is heated and vaporized (Figure 70). The length of smoke production can vary depending on the length of the pipe being

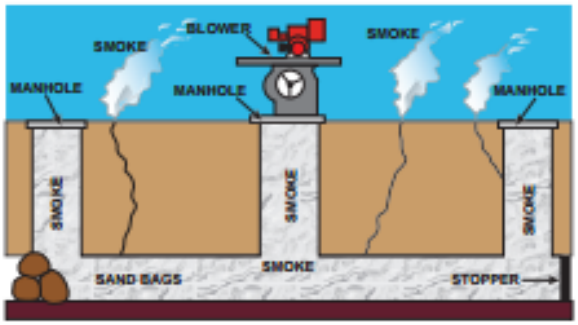


**Figure 68: Smoke Testing System Schematic**

**Figure 69: Smoke Candles**

**Figure 70: Smoke blower**

tested. In general, liquid smoke is not as consistently visible and does not travel as far as smoke from bombs (USA Blue Book).

Smoke blowers provide a high volume of air that forces smoke through the storm drain pipe. Two types of blowers are commonly used: "squirrel cage" blowers and direct-drive propeller blowers. Squirrel cage blowers are large and may weigh more than 100 pounds, but allow the operator to generate more controlled smoke output. Direct-drive propeller blowers are considerably lighter and more compact, which allows for easier transport and positioning.

Three basic steps are involved in smoke testing. First, the storm drain is sealed off by plugging storm drain inlets. Next, the smoke is released and forced by the blower through the storm drain system. Lastly, the crew looks for any escape of smoke above-ground to find potential leaks.

One of three methods can be used to seal off the storm drain. Sandbags can be lowered into place with a rope from the street surface. Alternatively, beach balls that have a diameter slightly larger than the drain can be inserted into the pipe. The beach ball is then placed in a mesh bag with a rope attached to it so it can be secured and retrieved. If the beach ball gets stuck in the pipe, it can simply be punctured, deflated and removed. Finally, expandable plugs are available, and may be inserted from the ground surface.

Blowers should be set up next to the open manhole after the smoke is started. Only one manhole is tested at a time. If smoke candles are used, crews simply light the candle, place it in a bucket, and lower it in the manhole. The crew then watches to see where smoke escapes from the pipe. The two most common situations that indicate an illicit discharge are when smoke is seen rising from internal plumbing fixtures (typically reported by residents) or from sewer vents. Sewer vents extend upward from the sewer lateral to release gas buildup, and are not supposed to be connected to the storm drain system.

## 13.4 Septic System Investigations

The techniques for tracing illicit discharges are different in rural or low-density residential watersheds. Often, these watersheds lack sanitary sewer service and storm water is conveyed through ditches or swales, rather than enclosed pipes. Consequently, many illicit discharges enter the stream as indirect discharges, through surface breakouts of septic fields or through straight pipe discharges from bypassed septic systems.

The two broad techniques used to find individual septic systems—on-site investigations and infrared imagery—are described in this section.

Appendix D
Illicit Discharge Ordinance

## DIVISION 3. - PROHIBITED DISCHARGE INTO SANITARY SEWERS AND STORM DRAINAGE SYSTEM

### Sec. 58-146. - Illicit connections prohibited.

It is unlawful to install any plumbing, pipe, or connection of any sort for the purpose of conveying any substances described below, including, but not limited to oils, greases, inflammable liquids (other than domestic grease), inflammable oils mixed with other substances or effluent, or any other substances besides those explicitly allowed by this code into any sewer or drain in the city.

(Ord. No. 851, § 1, 5-2-16)

Sec. 58-147. - Illicit discharges prohibited.

It is unlawful for any person to directly or indirectly discharge, place or cause to be discharged any of the following described substances into the city's sanitary sewers or storm drainage system:

(1) Any liquids, solids, or gases which by reason of their nature or quantity are, or may be, sufficient either alone or by interaction with other substances to cause fire or explosion or be injurious in any other way to the storm sewer system or receiving body. Prohibited materials include, but are not limited to, gasoline, kerosene, naphtha, benzene, toluene, xylene, ethers, alcohols, ketones, aldehydes, peroxides, chlorates, perchlorates, bromates, carbides, hydrides, and sulfides.

(2) Solid or viscous substances which will or may cause obstruction to the flow in sanitary sewers or the storm drainage system such as, but not limited to, grease, feathers, ashes, cinders, sand, spent lime, stone or marble dust, metal, glass, straw, shavings, grass clippings, rags, spent grains, spent hops, wastepaper, wood, plastic, gas, tar, asphalt residues, residues from refining or processing of fuel or lubricating oil, mud, glass grinding, or polishing wastes.

(3) Any water having a pH less than 6.0 or more than 10.0 or having any other corrosive properties capable of causing damage or hazard to structures or equipment.

(4) Any water containing toxic pollutants in sufficient quantity, either singly or by interaction with other pollutants to constitute a hazard to humans or animals, or create a toxic effect in the wastewater treatment plant or receiving surface waters.

(5) Any noxious or malodorous liquids, gases, or solids which either singly or by interaction with other wastes are capable of creating a public nuisance or hazard to life or are sufficient to prevent entry into the sanitary sewers or storm drainage system for their maintenance and repair.

(6) Any water having an aesthetically unattractive color which would cause an adverse effect to receiving body.

(7) Any effluent which creates conditions in the receiving wastewater treatment plant or surface waters which violate any statute or any rule, regulation, or ordinance of any public agency or state or federal regulatory body.

(8) Any water having a temperature greater than 150 degrees Fahrenheit (65.5 degrees Celsius), or causing, individually or in combination with other water, the influent at the receiving surface waters to have a temperature exceeding 104 degrees Fahrenheit (40 degrees Celsius) or having heat in amounts which will inhibit biological activity in the receiving surface waters.

(9) Any slug load, which shall mean any pollutant, including oxygen demand pollutants (BOD, etc.) released in a discharge of such volume or strength as to affect the receiving surface waters.

(10) Radioactive wastes or isotopes of such a half-life or concentration that they are in noncompliance with standards issued by the appropriate authority having control over their use.

(11) Water containing any toxic heavy metals in such concentrated strengths to cause adverse effects to the wastewater treatment plant or receiving surface waters.

Sec. 58-148—58-160. - Reserved.