

SOP ID-3: CATCHMENT INVESTIGATIONS

Introduction

Stormwater outfalls with evidence of illicit discharges may be identified. Various methods can be used to investigate the source of the discharge within each outfall catchment area. Common catchment investigation techniques include, but are not limited to:

- review of maps, historic plans, and records;
- manhole and catch basin inspection;
- dry and wet weather screening and sampling;
- video inspection;
- smoke testing; and
- dye testing.

This Standard Operation Procedure (SOP) outlines a systematic procedure to investigate outfall catchments and identify the source(s) of potential illicit discharges. Information and data collected as part of these catchment investigations is to be maintained and reported to the EPA annually.

Reference herein is also made to the 2017 New Hampshire Small MS4 General Permit (the Permit), the Town's Stormwater Management Plan (SWMP), and the Illicit Discharge and Detection Elimination Program (**IDDEP, Appendix D** of the SWMP).

Map and Record Review

The Town reviews relevant mapping and historic plans and records to identify areas in the municipal separate storm sewer system (MS4) with a higher potential for illicit connections. The following information is expected to be reviewed:

- plans related to the construction of drainage networks;
- prior work orders for storm drain system construction and repairs;
- Health Department or other municipal data on septic system failures or required upgrades; and
- records related to septic system breakouts.

From this review and other IDDEP required ranking criteria, catchments are prioritized for inspection through Year 10 of the Permit.

System Vulnerability Factors

The Town will identify and tabulate System Vulnerability Factors (SVFs). SVFs indicate a risk of potential sewage input to the MS4 under wet weather conditions, including the potential for failing septic systems.

The outfall/catchment inventory will be updated to include the following SVFs:

- storm drain infrastructure greater than 40 years old in medium and densely developed areas.
- areas of widespread code-required septic system upgrades due to inadequate soils, water table separation, or other physical constraints other than poor owner maintenance.

- sites with a history of multiple health department actions addressing septic system failures due to inadequate soils, water table separation, or other physical constraints other than poor owner maintenance.
- sites with a history of health department actions addressing septic system failures due to improper installation and/or poor owner maintenance.

Dry Weather Investigation (Manhole Inspections)

The Town will implement a dry weather storm drain network investigation that involves systematically and progressively observing, sampling (if applicable), and evaluating key junction manholes in the MS4 to identify potential or suspected illicit discharges.

The Town will be responsible for implementing the dry weather manhole inspection program and making updates to the mapping and inventories and ranking, as necessary. Updated infrastructure information will be incorporated into the storm system map, and catchment delineations will be refined, if needed, based on the field investigations. The outfall inventory with SVF data will also be updated based on information collected during field investigations, as applicable.

Important terms related to the dry weather manhole inspection program are defined by the MS4 Permit as follows:

Junction Manhole is a manhole or structure with two or more inlets accepting flow from two or more MS4 alignments. Manholes with inlets solely from private storm drains, individual catch basins, or both are not considered junction manholes for these purposes.

Key Junction Manholes are those junction manholes that can represent one or more junction manholes without compromising adequate implementation of the illicit discharge program. Adequate implementation of the illicit discharge program would not be compromised if the exclusion of a particular junction manhole as a key junction manhole would not affect the permittee's ability to determine the possible presence of an upstream illicit discharge. A permittee may exclude a junction manhole located upstream from another located in the immediate vicinity or that is serving a drainage alignment with no potential for illicit connections.

For all catchments identified for investigation, during dry weather field crews will systematically inspect key junction manholes for evidence of illicit discharges and confirm or identify potential SVFs. This program involves progressive inspection and sampling (if required) at manholes in storm drain networks to isolate and eliminate illicit discharges.

The manhole inspection methodology will be conducted in one of two ways (or a combination of both):

- by working progressively upstream from the outfall and inspecting key junction manholes along the way; or
- by working progressively downstream from the upper areas of the catchment toward the outfall and inspecting key junction manholes along the way.

For most catchments, manhole inspections will proceed from the outfall moving upstream along the system. However, the decision to move upstream or downstream in the system depends on the nature of the drainage system, the surrounding land use, and the availability of information about the catchment and drainage system. Moving up the system can begin immediately when an illicit discharge is detected at an outfall and only a map of the storm drain system is usually required. Moving down the system requires more advance preparation and reliable drainage system information on the upstream segments of the storm drain system; however, may be more efficient if the sources of illicit discharges are suspected or known to be located in upstream portions of the catchment area. Once a manhole inspection methodology has been selected, investigations continue systematically through the catchment.

Dry-weather inspection of key junction manholes is to proceed as follows:

1. Dry weather screening and sampling shall proceed only when no more than 0.1-inches of rainfall has occurred in the previous 24-hour period and no significant snow melt is occurring.
2. A field inspection form is provided with this SOP. Tools required for investigations are outlined in the IDDEP, **Table D6-1 Field Equipment**. Opening structures for investigation is a two-person task and requires that all safety precautions be taken.
3. Manholes will be opened and inspected for visual or olfactory evidence of illicit connections. The following are often indicators of an illicit discharge from stormwater outfall:
 - Foam: indicator of upstream vehicle washing activities, or an illicit discharge.
 - Oil sheen: result of a leak or spill.
 - Cloudiness: indicator of suspended solids such as dust, ash, powdered chemicals and ground up materials.
 - Color or odor: indicator of raw materials, chemicals, or sewage.
 - Excessive sediment: indicator of disturbed earth of other unpaved areas lacking adequate erosion control measures.
 - Sanitary waste and optical enhancers (fluorescent dyes added to laundry detergent): indicator of the cross-connection of a sewer service.
 - Orange staining: indicator of high mineral concentrations.
4. If flow is observed, a sample will be collected and analyzed. At a minimum, field testing will be completed for the following pollutants:
 - ammonia;
 - chlorine;
 - surfactants; and
 - bacteria (e. Coli by laboratory analysis).

Field kits can be used for these analyses, except for bacteria sampling, provided they meet the minimum threshold indicator concentrations as outlined in *Section 2.3.4.7.b.iii.4.b* of

the Permit. **Appendix DE** of the SWMP contains tables for parameter thresholds, field test methods, field kit information, equipment and instrumentation, and suggested supplies.

5. Sampling and analysis will be in accordance with procedures outlined in the IDDEP and Appendices within the SWMP, as well as EPA updates as available. Additional indicator sampling may also be necessary to assist in determining other suspected pollutants and sources, or for areas identified in the SWMP (or NHDES) with impaired waters and/or TMDLs.
6. Where sampling results, or visual or olfactory evidence indicates potential illicit discharges, the area draining to the junction manhole will be flagged for further upstream manhole investigation and/or isolation and confirmation of source(s).
7. Subsequent key junction manhole inspections will proceed upstream until the location of suspected illicit discharge(s) can be isolated to a pipe segment between two manholes.
8. If after a complete investigation of the drainage network in the suspect catchment no evidence of an illicit discharge is found, catchment investigations will be considered concluded upon completion of key junction manhole sampling, with documentation of the sampling results below applicable benchmarks, and steps taken to investigate the source.

Wet Weather Investigation (Outfall Sampling)

Where a minimum of one (1) SVF is identified in the outfall inventory or based on previous information or the during the catchment investigation, a wet weather investigation must also be conducted at the associated outfall. The Town will be responsible for implementing the wet weather outfall sampling program as defined in SOPs ID-2 and ID-4 and making updates to the SWMP map and outfall inventory, as applicable.

SVF Outfalls will be inspected and sampled under wet weather conditions, to the extent necessary to determine whether wet weather-induced flows or high groundwater in areas served by sewer or septic systems result in sanitary discharges to the MS4.

Wet weather outfall sampling will proceed as follows:

1. At least one wet weather sample will be collected at the identified outfall for the same parameters required during dry weather sampling. Field kits can be used for these analyses except for bacteria, provided they meet the minimum threshold indicator concentrations as outlined in *Section 2.3.4.7.b.iii.4.b* of the Permit. **Appendix DE** of the SWMP contains tables for parameter thresholds, field test methods, field kits, equipment and instrumentation, and suggested supplies.
2. Wet weather sampling will occur during or after a storm event of sufficient depth or intensity to produce a stormwater discharge at the outfall.
 - a. To the extent feasible, sampling should occur during the spring (March through June) when groundwater levels are relatively higher.

- b. Sampling during the initial period of discharge ("first flush") is to be avoided. This initial period is generally through the first 0.5-inch to 1-inch of rainfall, or 15-minutes after the start of a steady rainfall.
3. If wet weather outfall sampling indicates a potential illicit discharge, then additional wet weather source sampling will be performed, as warranted, moving upstream through key junction manholes until the sampling results do not indicate the suspected pollutant.
4. Once an upstream manhole field test is found to fall below pollutant thresholds (SOP ID-4), source isolation and confirmation procedures are to be followed as described below.
5. If wet weather outfall sampling of a catchment does not identify evidence of illicit discharges, and no evidence of an illicit discharge is found during dry weather manhole inspections, that catchment investigation will be considered complete. All documentation of a complete investigation is required to be included in the town's annual MS4 report to the EPA.

Source Isolation and Confirmation

Once an illicit discharge is approximated between two manholes, more detailed investigation techniques will be used to isolate and confirm the source of the illicit discharge. The following methods may be used in isolating and confirming the source of illicit discharges:

- sandbagging;
- CCTV/video inspections;
- smoke testing;
- dye testing;
- optical brightener monitoring; and/or
- illicit discharge canines.

These methods are described below. Public notification is an important aspect of a detailed source investigation program. Prior to video inspections, smoke testing, or dye testing, the Town will notify property owners in the affected area. Testing notification may include robocalls, hanging notifications on doors/mailboxes, in-person door-to-door, and/or email.

Sandbagging

This technique can be particularly useful when attempting to isolate intermittent illicit discharges or those with very little perceptible flow. The technique involves placing sandbags or similar barriers (e.g., caulking, weirs/plates, or other temporary barriers) within outlets to manholes to form a temporary dam that collects any intermittent flows that may occur. Sandbags are typically left in place for 48-hours and should only be installed when dry weather is forecast. If flow has collected behind the sandbags/barriers after 48-hours, the flow accumulation can be assessed using visual and olfactory observations, or by sampling. If no flow collects behind the barrier, the upstream pipe network can be ruled out as a source of the illicit discharge. This technique can be performed by a single person, however, identifying appropriate durations of dry weather and the need for multiple trips to each manhole can make this method both time-consuming and somewhat limiting.

Smoke Testing

Smoke testing involves injecting non-toxic smoke into drain lines and noting the emergence of smoke in illegally connected buildings or from cracks and leaks in the system itself. Smoke testing can also be effective in confirming and locating upstream or downstream structures within a drainage system. Typically, a smoke bomb or smoke generator is used to inject the smoke into the system at a catch basin or manhole and air is then forced through the system. A team of two or more people is needed to perform smoke testing (ideally, all with two-way radios). Test personnel are placed in areas where there are suspected illegal connections or cracks/leaks, noting any escape of smoke (indicating an illicit connection or damaged storm drain infrastructure). It is important when using this technique to make proper notifications to area residents and business owners as well as local police and fire departments.

It should be noted that smoke may cause minor irritation of respiratory passages. Residents with respiratory conditions may need to be monitored or evacuated from the area of testing altogether to ensure safety during testing.

Dye Testing

Dye testing involves flushing non-toxic dye into plumbing fixtures such as toilets, showers, and sinks and observing nearby storm drains and manholes as well as stormwater outfalls for the presence of the dye. Similar to smoke testing, it is important to inform local residents and business owners. Police, fire, and local public health staff should also be notified prior to testing in preparation of responding to citizen phone calls concerning the dye and the presence in local surface waters.

A team of two or more people is needed to perform dye testing (ideally, all with two-way radios). One person is located inside the building, while the others are stationed at the appropriate storm drain structures (which should be opened prior to adding dye) and/or outfalls. The person inside the building adds dye into a plumbing fixture (i.e., toilet or sink) and runs a sufficient amount of water to move the dye through the system. The person inside the building then radios to the outside crew that the dye has been added, and the outside crew watches for the dye in the storm drain system, recording the presence or absence of the dye over a set time.

This testing can be relatively quick (about 30 minutes per test), effective (results are usually definitive), and inexpensive. Dye testing is best used when the likely source of an illicit discharge has been narrowed down to a few specific buildings and the suspected dry-weather flow is perceptible.

Closed Circuit Television (CCTV)/Video Inspection

Another method of source isolation involves the use of mobile video cameras that are guided remotely through storm drain lines to observe possible illicit discharges or connections. IDDEP staff can review the videos and note any visible illicit discharges. While this tool is both effective and usually definitive, it can be costly and time consuming when compared to other source isolation techniques.

Optical Brightener Monitoring

Optical brighteners are fluorescent dyes that are used in detergents and paper products to enhance their appearance. The presence of optical brighteners in surface waters or dry weather discharges suggests there is a possible illicit discharge or insufficient removal by local septic systems or other wastewater treatment. Optical brightener monitoring can be done in two ways. The most common and least expensive methodology involves placing a cotton pad in a wire cage and securing it in a pipe, manhole, catch basin, or inlet to capture intermittent dry weather flows. The pad is retrieved at a later date and placed under UV light to determine the presence/absence of brighteners during the monitoring period. A second methodology uses handheld fluorometers to detect optical brighteners in a water sample collected from outfalls or ambient surface waters. Use of a fluorometer, while more quantitative, is typically more costly and is not as effective at isolating intermittent discharges as other source isolation techniques.

IDDE Canines

Dogs specifically trained to smell human related sewage are becoming a cost-effective way to isolate and identify sources of illicit discharges. While not widespread at the moment, the use of IDDE Canines is growing as is their accuracy. The use of these dogs is not currently recommended as a standalone practice for source identification; rather it can be used as a tool to supplement other conventional methods in order to fully verify sources of illicit discharges.

Illicit Discharge Removal

When the specific source of an illicit discharge is identified, the Town will exercise its authority as necessary to require its removal. The Permit annual report will include the status of all IDDEP investigations and removal activities including the following information for each confirmed source:

- the location of the discharge and its source(s);
- a description of the discharge;
- the method of discovery;
- date of discovery;
- date of elimination, mitigation, or enforcement action; and
- an estimate of the volume of flow removed.

Confirmatory Outfall Sampling

Within one (1) year of removal of an identified illicit discharge, confirmatory outfall sampling will be conducted. The confirmatory sampling will be conducted in dry weather unless SVFs have been identified, in which case both dry weather and wet weather confirmatory sampling will be conducted. If confirmatory sampling indicates continued evidence of or additional illicit discharges, the catchment will be scheduled for further investigations as described above. Confirmatory screening is not required in catchments where illicit discharges or SVFs have not been identified, or no previous screening indicated suspicious flows.

Follow-up Screening

Upon completion of each catchment investigation and illicit discharge removal and confirmation (as applicable), each outfall or interconnection will be scheduled for follow-up screening within three (3) years or sooner based on the catchment's illicit discharge priority. Ongoing screening will consist of dry weather screening and sampling consistent with the procedures described in the IDDEP and town SOPs. Ongoing wet weather sampling will also be conducted at outfalls where wet weather sampling was required due to SVFs and will be conducted in accordance with the procedures described in the IDDEP and town SOPs. All sampling results will be reported in the Permit annual reports.

Illicit Discharge Detection and Elimination Training

The Town will implement a training program for employees involved in the IDDEP, including how to recognize illicit discharges and the process related to illicit discharge investigation, removal, and enforcement. The permittee shall report on the frequency and type of employee training in the Permit annual report.

Attachments

SOP ID-3 *Drain Manhole Inspection Log*

Related Standard Operating Procedures

1. SOP ID-0 *Stormwater Sampling Quality Assurance Project Plan*
2. SOP ID-1 *Dry Weather Outfall Inspection*
3. SOP ID-2 *Wet Weather Outfall Inspection*
4. SOP ID-4 *Water Quality Screening in the Field*
5. SOP ID-5 *Locating Illicit Discharges*

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