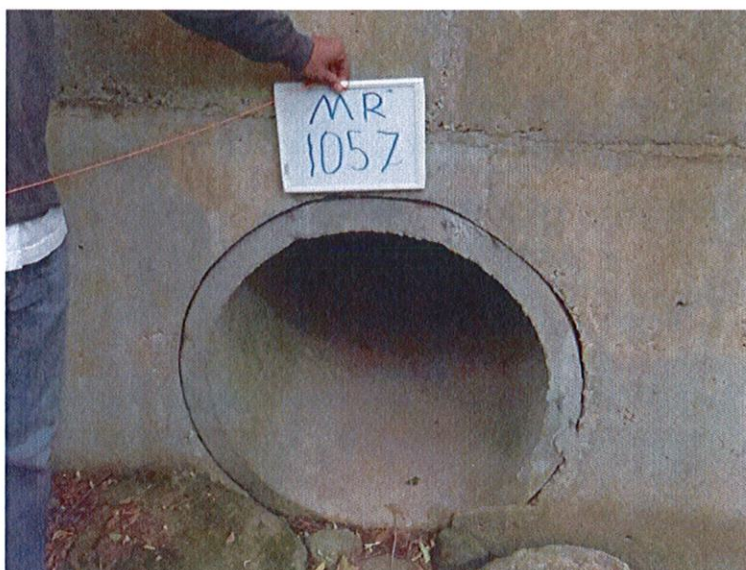




City of Haverhill

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ILLICIT DISCHARGE DETECTION AND ELIMINATION (IDDE) MANUAL



Revision 3.0 (June 2020)

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Section 1

Overview

An illicit discharge is generally any discharge, release, or pumping of a pollutant or polluted water into the stormwater system. The National Pollutant Discharge Elimination System (NPDES) regulates the discharge of stormwater under the authority of the Federal Clean Water Act.

This manual summarizes the city of Haverhill's Illicit Discharge Detection and Elimination (IDDE) program. The manual was developed to comply with the city's 2003 NPDES Phase II General Stormwater (Part II, Paragraph B.3). This control measure requires owners of regulated small municipal separate storm sewer systems (MS4s) to prepare and implement an IDDE program.

The city's IDDE program and its implementation satisfies one of the six minimum control measures in the Phase II permit (as discussed in Section I.I) to prepare and implement an IDDE program. The objective of this IDDE plan is to determine through outfall inspections if there is any potential for illicit connections in the stormwater piping system. The next step of the IDDE is to perform systematic, system-specific, investigations to identify and then eliminate the illicit discharges to the stormwater system.

1.1 Background of NPDES Phase II Stormwater Permit

In 1990, the U.S. Environmental Protection Agency (USEPA) promulgated Phase I of its stormwater program under the NPDES permit provisions of the Clean Water Act. Phase I addressed stormwater runoff from "medium" and "large" municipal separate storm sewer systems (MS4s) generally serving populations of 100,000 or greater, construction activity that would disturb five or more acres of land, and 10 categories of industrial activity. To further reduce the adverse effects of stormwater runoff, the EPA instituted its Stormwater Phase II Final Rule on December 8, 1999.

The Phase II Stormwater program is the next phase of enforcement under the USEPA's NPDES stormwater program for small MS4s. USEPA Region I is the regulatory authority responsible for the stormwater regulations for Massachusetts. The city of Haverhill must comply with regulations of the NPDES Phase II MS4 Permit issued May 1, 2003. This five-year permit expired in 2008 but, by law, the permit conditions continue until the permit is renewed. Currently, the USEPA has revised and re-issued the 2017 Phase II MS4 Stormwater General permit. The new permit should become effective July 1, 2017. The 2003 permit conditions remain in effect until a new 2017 Phase II permit becomes effective.

The Phase II Stormwater Permit regulates discharges from small MS4s located in "urbanized areas" (as delineated by the Census Bureau in the most recent census) and from additional small MS4s designated by the permitting authority.

The USEPA's 2003 Stormwater Phase II Rule states that a community must prepare and implement a stormwater management program, which must include the following six minimum control measures:

1. Public education and outreach on stormwater impacts
2. Public involvement and participation
3. Illicit discharge detection and elimination (IDDE)

4. Construction site stormwater runoff control
5. Post-construction stormwater management in new development and redevelopment
6. Pollution prevention and good housekeeping for municipal operations

The city developed a Stormwater Management Program plan, dated July 8, 2003, that identified how the city would comply with each of the regulations. A Notice-of-Intent was also submitted to the USEPA summarizing its annual operation procedures designed to comply with the 2003 Phase II General Permit. The city has submitted annual reports to the USEPA documenting the activities for each year, identifying activities for the next year, and completing a self-assessment of the city's efficacy in implementing its six minimum control measures. These annual reports are available at the DWP Wastewater Division or on the USEPA's Region 1 website at <https://www3.epa.gov/region1/npdes/stormwater/2003-permit-archives.html>.

1.2 Elements of an Effective IDDE Program

The NPDES MS4 Phase II Permit requires the following components as part of an IDDE Program:

1. A storm sewer system map showing the location of all outfalls, and the names and location of all surface waters of the state that receive discharges from those outfalls;
2. An ordinance or other regulatory mechanism to prohibit, to the extent possible, non-stormwater discharges into the MS4 storm sewer system and to implement appropriate enforcement procedures and actions if illicit discharges are identified;
3. A plan to detect and address non-stormwater discharges, including illegal dumping to the MS4 system and a program for dry weather stormwater outfall inspections;
4. An educational and information program to inform public employees, businesses, and the general public of hazards associated with illegal discharges; and
5. A list of occasional and incidental non-stormwater discharges that will not be addressed as an illicit discharge, i.e. charity car washes, etc.

As a simple summary, the purpose of the IDDE Program is to find, fix, and prevent illicit discharges to the city's stormwater system.

1.3 Resources

Various resources were used to develop this IDDE manual including:

- New England Bacterial Source Tracking Protocol, *USEPA Region I*, (draft, January 2012).
- Illicit Discharge Detection and Elimination Manual, *Ohio Environmental Protection Agency, Office of Environmental Education* (2005)
- Illicit Discharge Detection and Elimination Manual, *New England Water Pollution Control Commission* (January 2003)

Section 2

Illicit Discharges to MS4s

2.1 What is an MS4?

According to the EPA, the definition of an MS4 does not solely refer to municipally owned storm sewer systems, but rather, is a term with a much broader application that can include many other entities.

The regulatory definition of an MS4 is provided below:

A conveyance, or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains), which is:

- *Owned or operated by a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) including special districts under State law such as a sewer district, flood control district, or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act that discharges into waters of the United States;*
- *Designed or used for collecting or conveying stormwater;*
- *Not a combined sewer; and*
- *Not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2.*

Accordingly, this term includes systems similar to separate storm sewer systems in municipalities, such as systems at military bases, large hospitals or prison complexes, and highways and other thoroughfares. For example, the Massachusetts Department of Transportation (MADOT) Highway Division maintains a separate MS4 permit for the drainage system associated with the highways that cross through the city and MADOT must perform similar regulatory procedures for permit compliance.

As noted above, the city is considered to be a small MS4 and falls under the Phase II MS4 NPDES permit program.

The city of Haverhill Wastewater Division operates a sewer collection system served by both sanitary and combined sewer piping systems. Approximately 18 percent of the collection system, currently (2017), is served by a combined sewer pipes that convey both sewage and stormwater (from the city's catch basins in the combined sewer area, along with private inflow sources). The combined sewer portion of the system is predominately located in the older downtown areas of the city along the banks of the Merrimack and Little Rivers. This combined sewer system conveys dry-weather flow and a portion of the wet-weather flow downstream to the wastewater treatment plant (WWTP). When it rains, excess flow discharges to the rivers as combined sewer overflow (CSO). The CSOs are addressed under a separate state and federal regulatory program.

There are thirteen CSO outfalls; all of which have permanent identification signs to indicate that they are CSO outfalls. Seven of these outfalls are also shared by the separated MS4 stormwater pipe system. These seven outfalls are included in the MS4 program because they are also outfalls for the MS4 system.

The Wastewater Division Collection system field staff are cognizant of which outfalls are MS4 and CSO outfalls. The city had developed and maintains a Geographic Information System (GIS), accessible through handheld devices in the field, that allow staff to verify the status of each outfall. The field crews have a high level of understanding of the MS4 drainage system, including the roadway ditches, open channels, and drainage swales, which are located in the more rural parts of the system.

2.2 What is an Illicit Discharge?

An illicit discharge is defined by the USEPA as “any discharge to an MS4 (Municipal Separate Storm Sewer System) that is not composed entirely of stormwater...” with some exceptions. These exceptions include discharges from NPDES-permitted industrial sources and discharges from fire-fighting activities. Illicit discharges have been considered “illicit” because MS4s are not designed to accept, process, or discharge such non-stormwater wastes.

Examples of illicit discharges include:

- Direct or indirect sanitary wastewater discharges that connect to the storm sewer or watercourse, such as a shop 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.
- 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.

Some non-stormwater discharges are allowed under this permit as identified in the 2003 General Permit, Part I, Paragraph F. The city of Haverhill has reviewed this list and has not identified that any category or individual non-stormwater discharge in the list below as a significant contributor of pollutants to the MS4.

Thus, none of categories or individual discharges are not currently regulated under the city’s IDDE Program described herein.

- a. Water line flushing
- b. Landscape irrigation
- c. Diverted stream flows
- d. Rising ground water
- e. Uncontaminated ground water infiltration (as defined at 40 CFR § 35.2005(20))
- f. Uncontaminated pumped ground water
- g. Discharge from potable water sources
- h. Foundation drains

- i. Air conditioning condensation
- j. Irrigation water, springs
- k. Water from crawl space pumps
- l. Footing drains
- m. Lawn watering
- n. Individual resident car washing
- o. Flows from riparian habitats and wetlands
- p. De-chlorinated swimming pool discharges
- q. Street wash waters
- r. Residential building wash waters without detergents

As noted above, discharges or flows from firefighting activities are allowed under this permit need only be addressed where they are identified as significant sources of pollutants to waters of the United States.

In most communities, the MS4 is directly connected to a waterbody and does not receive any type of treatment prior to its discharge to receiving water bodies of the United States. Because the flow in these piping system receives no treatment, it is vital that only stormwater be discharged from these MS4s. If the city finds that any of these types of discharges listed above are causing a water quality impact, the city may remove it from the list of exempted categories.

2.3 Types of Illicit Discharges

For any IDDE program to be successful, it is important to clearly understand the different types of illicit discharges so that individuals can take the necessary steps for elimination. This includes frequency of discharge and surrounding land use issues as well. Once the city can investigate the frequency of discharge and land use issues associated with these discharges, then the possibility exists to trace the illicit discharge back to its source and eliminate it.

Illicit discharges can be separated into the three categories listed below based on frequency of discharge.

Transitory Illicit Discharge: These are typically a one-time event. They can result from spills, dumping, and line breaks. These types of discharges are often the most difficult to investigate and trace back to its source. For example, in some communities, residents have used catch basins as a dumping point for the disposal of animal waste, household cleaning products, pesticide, or vehicle fluids (oils, antifreezes, etc.) and even lawn clippings, which all could contribute to water quality degradation of the receiving water body. Watershed activities as unassuming as charity carwashes might also contribute to pollution if the runoff is collected into a catch basin in the separated portion of the sewer system. Public employee and public education, spill and illicit dumping reporting, and defined investigative procedures are some of the best methods for reducing and controlling this type of illicit discharge.

Table 1, next page, provides additional information on System Vulnerability Factors, and the types of land use within the city that may cause indirect discharges to the stormwater system.

Table 1 – System Vulnerability Factors - Land Uses and Activities That Could Produce Transitory or Intermittent Illicit Discharges

Land Use	Potential Source Locations	Condition/Activity that Might Result in an Illicit Discharge
Residential	• Apartments • Multi-family • Single Family Detached	• Car Washing • Driveway Cleaning • Dumping/Spills • Equipment Wash-downs • Lawn/Landscape Watering • Septic System Maintenance • Swimming Pool Discharges • Laundry Wastewater • Improper Plumbing (garage floor drains)
Commercial	• Campgrounds/RV Parks • Car Dealers/Rental Car Co. • Car Washes • Commercial Laundry • Gas Stations/Auto Repair Shops • Marinas • Nurseries and Garden Centers • Oil Change Shops • Restaurants • Swimming Pools	• Building Maintenance (power washing) • Dumping/Spills • Landscaping/Grounds Care (irrigation) • Outdoor Fluid Storage • Parking Lot Maintenance (power washing) • Vehicle Fueling • Vehicle Maintenance/Repair • Vehicle Washing • Wash-down of Greasy Equipment & Grease Traps
Industrial	• Auto Recyclers • Beverages and Brewing · Construction • Vehicle Washouts Distribution Centers • Food Processing • Garbage Truck Washouts • Marinas, Boat Building and repair • Metal Plating Operations • Paper and Wood Products Petroleum • Storage and Refining · Printing	• All Commercial Activities • Industrial Process Water or Rinse Water • Loading and Un-loading Area Wash-downs • Outdoor Material Storage (fluids)
Municipal	• Landfills • Maintenance Depots • Municipal Fleet Storage Areas Ports • Public Works Yards • Streets and Highways	• Building Maintenance (power washing) • Dumping/Spills • Landscaping/Grounds Care (irrigation) • Outdoor Fluid Storage • Parking Lot Maintenance (power washing) • Road Maintenance • Emergency Response • Vehicle Fueling • Vehicle Maintenance/Repair • Vehicle Washing

As part of its 2003 NOI and Stormwater Management Program, the city established an email for public, which is stormwater@cityofhaverhill.com, to report on illicit discharges to the

stormwater system or to ask questions. The city also maintains a hotline (978) 374-2334 for public reporting or comment. Public complaints are recorded and conveyed to the Department of Public Works and staff are dispatched to investigate.

- ***Intermittent Illicit Discharge:*** These are discharges that occur sporadically. They can occur several hours per day, week or over the course of a year. They can happen as the result of line breaks or cross connections. The hotline telephone number or email above allows the public to call or communicate if any unanticipated discharges are observed.
- ***Continuous Illicit Discharge:*** These direct connections into the MS4 can be from sanitary sewers, cross connections, infrastructure problems with a sanitary sewer system, or malfunctioning household sewage treatment systems. This type of discharge is the easiest to find, investigate, trace and eliminate from the MS4. These types of discharges also have the greatest impact because of the constant pollutant loading into a water body.

Some areas of the system may be more susceptible to polluted discharges than other areas in the stormwater system (Center for Watershed Protection & Pitt, 2004) including:

- Locations where there have been repeated problems in the past including sanitary sewer overflows (SSOs). This could include areas with water quality data or where there have been repeated complaints. Sanitary Sewer Overflows (SSOs) for the City are primarily unanticipated problem level events and are reported and investigated in a timely manner. SSOs are reported yearly and published on the City public website. Historical records of SSOs can be located in Appendix H and the City public website.
- Older areas of a community typically have a higher percentage of illegal connections. In addition, deteriorating sewer pipes can allow wastewater to exfiltrate out of the sanitary lines and into the surrounding environment.
- Commercial and industrial areas tend to have a higher percentage of illicit discharges.
- Areas with large and/or many storage vessels of hazardous solids or liquids.

This information was generally used to prioritize system investigations and monitoring.

2.4 Mode of Entry to MS4 Waterbody

In addition to being classified by type, illicit discharges can also be classified based on how they enter the MS4 or storm drain system. This entry can be direct or indirect.

2.4.1 Direct Entry

Direct entry means that the discharge is directly connected to the storm drainpipe system via a pipe. This type of entry will produce discharges that are either continuous or intermittent. Direct entry usually occurs when there are sewage cross-connections, or where there are industrial and commercial cross-connections.

2.4.2 Indirect entry

Indirect entry means that flows, which are generated outside the storm drain system, enter through storm drain inlets or by infiltrating through the joints of the pipe. Generally, indirect modes of entry produce intermittent or transitory discharges. This type of entry can include groundwater seepage into

the storm drainpipe, spills, dumping, outdoor washing activities, and irrigation from landscaping or lawns that reaches the storm drain system.

2.5 Finding and Preventing Illicit Discharges

Discharges from MS4s can often include wastes and wastewater from non-stormwater sources, including illicit discharges, which can enter the system through various means. The result of this is untreated discharges that could potentially contribute river pollutants, including heavy metals, toxics, oil and grease, solvents, nutrients, viruses, and bacteria to receiving water bodies. USEPA studies have demonstrated that pollutant levels from illicit discharges in MS4 outfalls could be high enough to degrade receiving water quality and threaten aquatic, wildlife, and human health.

The objective of the USEPA's IDDE minimum control measure is to have regulated, small MS4 operators gain a thorough awareness of their systems and position themselves to take necessary actions on eliminating illicit discharges. This awareness will allow them to determine the types and sources of illicit discharges entering their water bodies. This manual will help establish the legal, technical, and educational means needed to prevent and eliminate these discharges.

Section 3

Mapping/Inventory

Development and maintenance of a current system map and an inventory of the features and facilities in the stormwater system are important to perform the IDDE program.

3.1 Current Mapping

The city initiated development of its GIS in 2003 using existing large-scale system records and plans from the City Engineer's Office to generalize the locations of features such as drain pipes, catch basins, drain manholes, and stormwater outfalls. The data was then utilized to develop the GIS stormwater database and attributes with mostly planimetric data. This method produced rough estimates of features and locations, such as pipe size and material, manhole locations, and flow direction. The initial data base also included some pipe inverts, which could be readily identified from available city maps.

Since the initial creation of the stormwater system map, the city continues to implement new programs and field investigations to add new features, update existing GIS data, and incorporate system pipe information to increase the validity and accuracy of the stormwater system (including outfalls, pipe connectivity, catch basins, and drain manholes). Approximately 600 additional MS4 outfalls (for a total of approximately 1,200 outfalls) were located and mapped during the 2014/2015 Dry-Weather Stormwater Outfall Inspection Program.

The city self-performs many of the update programs utilizing Wastewater Division and City Engineering staff. City Engineering staff are primarily responsible for updating the GIS based on reviews of existing plans, new design plans for system modifications, and field verified updates (by Wastewater Division investigations). The city has also developed and integrated mobile web-based software that allows field crews to update GIS features on-line with Arc GIS on Line (AGOL). This software link is available on the field crew's mobile field devices (currently iPads). Thus, whenever there is a conflict between field measurement and current GIS attribute information, corrections can be made that are available nearly immediately.

In compliance with the Phase I and II NPDES MS4 IDDE requirements, Appendix A includes a figure showing the locations of all outfalls, and the names and locations of all receiving water bodies.

3.2 Stormwater Outfall Identifiers

Haverhill has adopted a naming convention in the GIS to identify the outfall location based on the receiving water. The first letters of the receiving water body name (in the table below) are the prefix to a unique identification number based on the numbering sequence for that water body (such as "CB-13"). Table 2 summarizes the acronym prefix used for each receiving water.

For some outfalls that discharge to small, unnamed water bodies, the nomenclature "UNK" or unknown was assigned. "DPI" and "DPO" were assigned to miscellaneous stormwater detention ponds identified during the system investigations.

Table 2 – Acronyms used to identify Receiving Water Bodies in Haverhill

Receiving Water Acronym	Receiving Water Body
BB	BRADLEY BROOK
BZB	BUSWELL BROOK
CB	CREEK BROOK
CC	COTTLES CREEK
CL	CRYSTAL LAKE
CP	CHADWICK POND
DPI	DETENTION POND INLET
DPO	DETENTION POND OUTLET
FB	FISHING BROOK
FP	FREY'S POND
JC	JOHNSTON'S CREEK
JP	JOHNSONS POND
KL	KENOZA LAKE
LS	LAKE SALTONSTALL
LR	LITTLE RIVER
MB	MILLVALLE BROOK
MR	MERRIMACK RIVER
PB	PEABODY BROOK
PL	PENTUCKET LAKE
SB	SNOW BROOK
TS	TILTON SWAMP
UNK	UNKNOWN
WT	WETLAND
WMB	WEST MEADOW BROOK

Section 4

Legal and Public Responsibilities

4.1 Stormwater Ordinance

The city of Haverhill currently has sewer regulations in place (see <http://ecode360.com/6261515>), Chapter 208 of the City Code, that partially address stormwater. The city has developed an amendment to these regulations, which should become effective February 21, 2017, that complies with the IDDE requirements for a stormwater ordinance including:

- prohibiting illicit discharges and illegal connections to the stormwater system;
- identifies the Superintendent of Public Works as the enforcement authority; and
- identifies civil and criminal penalties for non-compliance.

The city will be proposing further amendments to Chapter 208 or a new chapter to address construction and post-construction stormwater management and will be developing an IDDE Enforcement Manual to detail the enforcement procedures the city would perform to ensure the elimination of any and all illicit discharges (as they are identified or encountered) and adherence to any future construction site stormwater management requirements.

One source of illicit discharges to the city's MS4 system is illegal dumping. The city's stormwater ordinance will prohibit illegal dumping activities and include monetary penalties for persons that violate this ordinance. However, these activities are difficult to identify and locate (as they may be temporary and not readily visible). The city's future educational and training programs will increase focus on the issue of illegal dumping and its impact to the MS4 system.

4.2 City Department Responsibility

The Deputy Director of the Haverhill Department of Public Work is primarily responsible for the development, implementation, and annual assessment and revision of this IDDE program. The Wastewater Division Collection System Supervisor and Wastewater Compliance Industrial Pretreatment Coordinator are primarily responsible for the day-to-day implementation of the program and record keeping. The Wastewater Division will coordinate with other city departments as necessary to find, fix, and prohibit illicit discharges.

4.3 Public Education and Employee Training Programs

The city of Haverhill implemented its public employee and general public education/training activities for the 2003 permit. The city is considering the types and extent of public education and training program that it will implement in the future to improve its identification and control of illicit discharges and to comply with the permit requirements.

As part of the city's public outreach program, outreach material in print form will be made available to the public. The education campaign will also rely upon the city's website, brochures, print ads, and/or fact sheets to make the public aware of storm water, water pollution, and inform them of the city's hotline for reporting on possible illegal dumping, connections, or discharges.

4.3.1 Public Employees

Future educational training, especially on spill/illicit discharge identification and prevention, will likely involve all DWP employees, fire and safety employees and some public employees. Training

sessions may include the types of illegal dumping in catch basins and other locations and how to spot dumpers. It will also include education on environmental and water quality issues and the importance of keeping non-stormwater discharges from entering MS4 receiving waters.

Trained public employees are more likely to recognize the signs of non-stormwater discharges. Employees whose jobs keep them outside and mobile should be able to help spot illegal dumpers and hazardous spills. Fire and police departments who respond to these spills will be able to help keep non-stormwater discharges out of the storm sewer system and adjacent water bodies. In addition, planning, health, and conservation department employees who participate in building and construction inspections will be able to ensure that illegal connections to the stormwater system are not permitted.

For those staff directly assigned to the IDDE program, the Wastewater Compliance Industrial Pretreatment Coordinator will manage annual on-the-job training. That person will manage and assign training as described below. Detailed training will be assigned to those individuals assigned to immediate response procedures, source tracking of potential illicit discharges and sampling. City staff directly involved with Stormwater investigations and reporting will train annually via seminars, webinars, or conferences as available to stay apprised of new processes or procedures to assist in maintaining the IDDE program.

For example, before initiating the Dry-Weather Outfall Inspection Program, the Wastewater Compliance Industrial Pretreatment Coordinator held a training program to educate in-house field staff on the purpose and objectives of the field program, the approach to field investigations, review of the outfall inspection procedures, sample collection requirements and protocols, and record keeping. At the start of the upstream tracing program, the Wastewater Compliance Industrial Pretreatment Coordinator held similar training.

General training of other staff not directly assigned to field activities will be via printed material distributed to staff at staff meetings. DVD, print or webcast material may be distributed if the need arises as the program develops.

4.3.2 Businesses

Education of local businesses and contractors and developers is important to show them how their activities can have a potential impact on water pollution and to inform them of illegal connections. The city intends to develop a brochure to inform businesses about water pollution and non-stormwater and illicit discharges. The city may include the Greater Haverhill Chamber of Commerce in the educating process and use their resources to encourage greater knowledge of stormwater issues.

4.3.3 General Public

General public education is important to increase awareness of environmental and water quality issues. During this outreach, it is important to get the public engaged and involved in the process. For this effort, the city will develop and distribute outreach materials such as those for the businesses. These brochures will include information on water pollution, stormwater problems, descriptions of illicit stormwater system discharges, and the overall IDDE program.

Education to increase public awareness could also encourage public reporting of illicit discharges/dumping when they are observed. To facilitate public reporting, the city will consider reestablishing a hotline, via the city's internet site or the hotline phone number, for residents to

inform the city of when they observe situations that are affecting the city's MS4 system.

Once residents are educated on the environmental impacts and water pollution issues, it is important to give them opportunity to dispose of their hazardous waste and other harmful chemicals in the proper way as to avoid any discharge of these pollutants to MS4 water bodies. The city currently has a household hazardous waste disposal/recycling program that allows residents to drop off items such as pesticides, pool chemicals, brake fluid, oil paint, fluorescent bulbs, and other hazardous items. Flyers are printed to advertise the hazardous waste recycling days and information is easily available on the city's internet website. The city also has an additional fee-based recycling program in place for items such as latex paint, motor oil, radioactive waste, etc.

4.4 Reporting and Recordkeeping

All IDDE inspections, corrective, and enforcement actions will be recorded using the city's CCMS application..

Public comment/feedback will be conveyed to the Deputy DPW Director and Wastewater Compliance Industrial Pretreatment Coordinator to ensure that the program is responsive to citizen complaints. The public will be directed to either the DPW directly or the hotline if they have general comments they would like to make on the city's IDDE program.

Tracking and documentation is a required part of the IDDE program. Spills reported to the complaint hotline will be recorded in the city's CCMS application. Field personnel who discover or are involved in a spill will contact the Collection System Supervisor to ensure that proper documentation of the incident is maintained.

Section 5

Detection and Elimination Program

5.1 Background

The 2003 Phase II NPDES permit requires each stormwater authority develop, implement, and enforce a program to detect and eliminate illicit discharges including procedures to:

- Prioritize areas for investigations;
- Locate potential illicit discharges (outfall inspections);
- Track and trace potential sources of illicit discharge(s);
- Remove illicit discharges when discovered; and
- Document of actions and evaluation of impacts

5.2 Investigation Priorities

To develop general priorities for system investigations, the city reviewed its GIS database and other available information. Table 3 below summarizes the USEPA suggestions for screening factors that could be used to identify system priorities for future investigations and its applicability in Haverhill.

Table 3 – USEPA Screening Factors for Setting Investigation Priorities

Outfall Screening Priority Factor	Issues Suggesting Higher Priorities	Applicability
Past discharge complaints and reports	Areas with higher complaints or problems	City had no chronic complaint or system problems to prioritize.
Poor dry weather water quality	Poor dry weather water quality in the river and/or from past outfall sampling	There was no past sampling of outfalls and river quality information did not readily indicate higher priorities
Density of potential generating sites	Highly commercial areas with existing NPDES stormwater permits	There are no dense commercial areas in the city that suggest higher priorities
Stormwater outfall density	Number of outfalls per miles	The density of outfalls is highest along the Merrimack River in the downtown areas
Age of subsystem	Aging piping systems that could be leaking	The oldest systems are in the downtown area
Sewer conversion	Areas that formally had septic systems	There are not widespread areas in the system that have been converted from septic
Former combined sewer system	Areas served by former combined sewer systems	There are not widespread areas of the system that have been converted from combine sewer areas
Presence of older industrial operations	Areas with past industrial operations may have unidentified connections	The areas with historic industrial operations are all in the downtown areas
Aging or failing sewer infrastructure	Older sewer systems could be leaking into stormwater system	Older sewer systems are located in the older downtown area
Density of aging septic systems	Failing septic systems could be leaching into storm piping system	Septic systems are all located in the outskirts of the city of Haverhill. There is no reported information on their failure rates.

Accordingly, there is not a lot of information readily available to help the city establish relative priorities to guide the outfall inspection program. Thus, the city elected to assign the highest priorities to the area surrounding the Little River and the Merrimack River in the older downtown portion of the city.

Appendix B includes a map showing the relative priorities for outfall investigations. There are several Class A water bodies in the city (Crystal Lake, Kenoza Lake, Millvale Reservoir, Johnson Pond, and Round Pond) and Lake Saltonstall, which is a Class B water body with a swimming area, which are higher priorities for the outfall inspection program. Inspections of the stormwater outfalls around these water bodies will be completed in the first priorities of inspections.

5.3 Stormwater Outfall Inspection Program

Based on these general inspection priorities, the city completed an initial dry-weather stormwater outfall inspection program in 2014 and 2015. This outfall inspection program began in September 2014 and progressed as weather conditions allowed. Dry weather screening and sampling was generally performed only when no more than 0.1 inches of rainfall occurred in the previous 24-hour period. A training meeting was held with in-house staff before the field program started.

The field crews used computer tablets to assist in their investigations. As noted above, the tablets allowed the field crews access to the real-time GIS database to help identify outfall locations, using the Geographic Positioning System (GPS) functions. The tablets also provided the crews with the capabilities to make on-line modifications to the GIS to reflect field observations. These GIS modifications were later reviewed by City Engineering staff, compared to existing mapping in the office, and adopted or re-investigated (as required), as an iterative approach to updating the GIS database.

The goal of this program was to identify and inspect every known stormwater outfall within the city for potential illicit discharges. In addition, city staff “walked” the riverbanks to identify and inspect undocumented stormwater outfalls. The riverbank inspections were primarily performed by foot, during low tides, but inspection of some areas of the river(s) had to be completed by boat to gain access to the outfalls, which was arranged with the Haverhill Harbormaster. When practical, the river banks were inspected during fall and winter periods when vegetation was gone to locate undocumented outfalls.

The sequence of investigations generally followed the priorities listed above with consideration of access constraints due to tides and river elevations. The field team visited sites when river levels were low enough to take representative samples of any dry-weather flow. If multiple attempts were not successful, then the field crews were instructed to take samples from the next upstream and appropriate drain manhole.

Initially, the city’s GIS indicated that there was about 600 outfalls. During the 2014/2015 investigations, another 596 undocumented outfalls were located. Many of these are outfalls for private or institutional (MADOT) drainage systems and were not included in the city’s IDDE program. Of the total of 1,200 outfalls identified and inspected during this program, there are about 816 outfalls attached to city-owned piping systems.

5.3.1 Outfall Inspection Procedures

The field inspection team generally used existing GIS mapping, using field computer tablets, to locate each known outfall within the city, beginning with the priority areas, during dry weather. The tablets allowed staff to view existing stormwater piping in the area to align piping to potential outfall locations.

For every outfall, new or previously known, the field crew took photograph(s) and completed the Stormwater Outfall Inspection Form (Sections 1 through 3). Field crews recorded observations/characterizations about the outfall pipe, adjacent pool, and surrounding area. The description and the physical condition of the outfall, including the material, shape, diameter, and submergence were also recorded. Crews also made observations about any outfall damage, deposits or stains, and abnormal vegetation at each location. Finally, the crews recorded any observations of evidence of past illicit discharges such as discoloration, smells, sheens, paper and hygiene products, or any other evidence of potential sanitary or non-stormwater discharges through the outfall. The Stormwater Outfall Inspection Form is included in Appendix C.

During the inspection program at each outfall, field crews would visually survey the adjacent banks of the receiving water to potentially spot undocumented outfalls. When new outfalls were spotted, the field crew completed an inspection report form and recorded the GPS location of the new outfall on the computer tablet in GIS. When new outfalls were spotted, a new unique identifier was assigned to the new outfall immediately so that the inspection form could be connected to the new outfall.

Each completed inspection form was scanned and attached to the MaintStar record for the day's activities. Eventually, the city intends to connect each inspection form to the outfall attribute in GIS.

5.3.2 Dry Weather Flow Sampling and Procedures

One objective of the outfall inspection program is to determine if there is dry weather flow at the stormwater outfall. Dry weather flow at the outfall is a potential indicator that there could be an illicit connection somewhere in the upstream drainage system subcatchment or tributary area. Characterization the relative quality of the dry-weather flow (via qualitative field assessment and quantitative field-sampling equipment or laboratory tests) can help to determine if the flow is polluted by a potential upstream illicit connection.

When dry weather flow is present at an outfall, the additional Sections 4 and 5 of the Outfall Inspection Form were completed. Field crews made observations of the flow quantity (minimal, moderate, or substantial) and noted the physical characteristics of the flow, including odor, color, turbidity, and any floatables such as sewage, suds or foam, or grease. Observations are also made of outfall location and condition via the Outfall Inspection/Investigation Form. Crews then completed several on-site sampling tests for temperature, pH, specific conductivity, salinity, chlorine (added in 2015), ammonia, and surfactants. Crews were trained to collect a sample for field measurements that represented the flow from the outfall and not from any adjacent discharge pools. The Outfall Inspection Form included the threshold parameters for these tests so that the crews were aware of the dry weather flow characteristics that might indicate the potential of an upstream illicit connection.

Field testing for temperature and pH using Hanna Instruments portable pH meter, specific conductivity and salinity of the sample are completed using a field meter probe stick (EXTECH

EC500). Surfactants concentrations are obtained using a Hanna Instruments HI96769 portable photometer or outside lab analysis. Chlorine residual measurements are obtained using a portable pocket HACH colorimeter. Ammonia and bacteria samples are sent to an outside lab for analysis. Any testing parameters sent for outside lab analysis will be notated as such in the IDDE sampling report. As noted above, all field crew were trained prior to the start of the Stormwater Outfall Inspection Program. Training procedures for field inspections and dry weather sampling inspections are be found in Appendix D.

Once all field testing of dry-weather flow was completed, the outfall was marked for subsequent sample collection and laboratory testing for bacteria (E. Coli or Enterococci). The outfall was then revisited on another day so that a batch of bacteria samples could be collected from multiple outfalls with dry weather flow for coordination with the laboratory and in compliance with the parameter hold times. Samples were collected of all dry weather outfall flow and tested at an outside laboratory.

Most of the receiving waters (for stormwater discharges) in and around Haverhill are Class B or Class SB (marine influenced waters), according to the Massachusetts Surface Water Quality Standards (WQS), and have a limit of 260 MPN/100ml for E. coli (Class B) and 61 MPN/100ml for Enterococcus (Class SB). The lower portion of the Merrimack River, downstream of the Little River, is the only receiving water classified as Class SB; dry weather flow from outfalls into this segment of the Merrimack River were tested for Enterococcus. There are five Class A waterbodies in Haverhill including Crystal Lake, Millvale Reservoir, Kenoza Lake, Round Pond, and Johnson Pond; the WQS E. Coli limit is 126 MPN/100ml for these waterbodies.

A minimum sample of 100 ml of dry weather flow was collected in order to be processed by the lab correctly. During the initial program, sample collection was coordinated with the city crews and a CDM Smith staff member, who was responsible for collecting the dry weather flow sample bottles, completing the laboratory Chain of Custody form, and delivery of the samples to the laboratory within the required hold times. This is discussed in the document in Appendix D.

5.3.3 Summary of the Dry-Weather Outfall Inspection Program

The city's 2014/2015 Dry-Weather MS4/Stormwater Outfall Inspection Program summary and results were submitted to the regulatory agencies in a report dated April 2016. Bacteria concentrations in outfall dry weather flow were the main parameter used to determine the potential for upstream illicit connections at each outfall.

Of the 816 public outfalls in the city of Haverhill, a total of 114 outfalls had observable dry-weather flow. All of these were tested for bacteria. Of the 104 outfall with dry weather flow, 78 outfalls had bacteria levels that were below the WQS listed above. Thirty-six (36) outfalls had bacteria levels that exceeded the WQS limits.

Based on relative bacteria concentrations, the city prioritized its future source tracing program that will be conducted in the upstream tributary watersheds as follows:

- **Problem Priority** Ten (10) outfalls with E.coli greater than 2,400 MPN/100ml
- **High Priority** Nine (9) outfalls with E.coli between 1,000 and 2,400 MPN/100ml and five (5) outfalls with Enterococcus above 61 MPN/100ml
- **Low Priority** Twelve (12) outfalls that had E.coli greater than 260 MPN/100 ml up to

1,000 MPN/100ml.

-
- **Excluded Priority** Thirty-one (31) outfalls with non-bacteria factors for further testing/investigation

Table 3, excerpted from the 2014/2015 Dry-Weather MS4/Stormwater Outfall Inspection Program, lists the city's future source tracing priorities for each of the outfalls. This table was revised from the April 2016 report to include two additional outfalls.

5.4 Illicit Discharge Source Tracing

5.4.1 Introduction

Based on the relative priorities for further drainage system investigations, the city will perform illicit discharge source tracing within each of the affected outfall tributary areas. Illicit discharges are sometimes easily traced and removed but in other areas, especially with intermittent sources, it may require much more field time and effort to locate the illicit discharge.

There are many potential approaches to illicit discharge source tracing. The general procedures apply but the approach for individual areas will be determined by several factors including, but not limited to, cost of technique, size of catchment area, pipe diameter, existing available mapping, and level of contamination. Proper record keeping is key to providing accurate progress of source tracing including; number of catchments inspected in relation to the total catchment area. This will allow City staff to reprioritize source tracing investigations every 5 years per the NPDES MS4 permit. A combination of the investigation techniques may also be used to expedite the investigation process and locate the illicit connection more quickly, if applicable.

For the Problem priority investigations, the city adopted an iterative approach designed to fast track identification of these sources, especially since the bacteria concentrations are high and likely easily traceable. The city may select a different approach for the Medium and Low priority investigations. Accordingly, many of the potential tracing approaches are discussed below.

Documentation of the field reconnaissance is an important task. A field notebook and proper documentation equipment, whether electronic or manual, should be available and used at all times to record field observations and the tests conducted. Keeping logical and appropriate field records of date and time of inspection, location and type of structure being inspected, presence or absence of flow or evidence of contamination, location and type of building suspected of illicit connection, flow samples collected and analyzed, and actions taken are essential to the evaluation and refinement of the city's IDDE source tracing program.

Before starting the IDDE source tracing effort, the Wastewater Compliance Industrial Pretreatment Coordinator met with the field crews to discuss the purpose and investigative approach for the field effort. Periodic meetings were held with the field crew to discuss the findings to-date and to consider alternate approaches or more intensive testing to locate the potential illicit discharges.

5.4.2 Tracing Methods

There are two basic methods used to locate an illicit connection are the “top down” approach and the “bottom up” approach. These two methods are designed to investigate the structures within each outfall subcatchment, or tributary area.

- *Top Down Method* – This method begins at the uppermost upstream manhole within the tributary area of a contaminated outfall. Working downstream, subsequent drain manholes are opened and inspected for dry weather flow and visual evidence of contamination. When flow or evidence of flow is present, then the general inspection and flow sampling procedures are followed and further investigation continues downstream to the outfall.
- *Bottom Up Method* – This method begins at the outfall and progresses upstream to investigate storm structures in the tributary area for dry weather flow or evidence of contamination. Continuing upstream until a structure has no flow or evidence of flow and then the general inspection and flow sampling procedures are followed.

The first step for each field investigation will be the preparation of an overall piping plan of the subwatershed. This plan will allow the city staff to develop the best investigative approach for each area. In some cases, based on available information, land uses, or staff operating knowledge, it may be more practical to target the focus of field investigations if there are pockets of known problems in the system.

The city of Haverhill will primarily use the “bottom up” method. For some problematic outfall tributary areas, however, it may be more applicable, or cost effective, to use the “top down” method. This will be decided after reviewing the drainage basin boundaries and extent.

5.4.3 General Procedures to Locate Illicit Connections in Haverhill

The following steps can be used in determining a source of an illicit discharge from a drain structure. These steps are a general overview of the potential field procedures that could be used and are not necessarily in order of priority. Any of the techniques or combination of techniques may be used depending on the individual outfall tributary area.

- Select either a top down or bottom up approach and systematically follow the potential source from its start to the outfall or vice versa via drain manholes. Visual observations at each manhole can be supplemented by field measurements or tests of water quality or laboratory tests of bacteria (similar to those used above for the outfall screening).

Haverhill elected to complete initial screening of the flow quality in each manhole using Fecal Coliform tests for the High Priority outfalls. Fecal coliform tests could be performed by the wastewater treatment plant (WWTP) laboratory staff, where results could be readily obtained and utilized to inform the next day’s investigations. For areas where the city is using Fecal Coliform testing as a fast-track screening approach, the city is aware that final testing of the outfall will have to be completed in compliance with the bacteria standards in the state WQS.

- Field crews used the field observations and sampling data to pinpoint the potential segment of pipe from manhole to manhole that could be the location of any illicit discharges. This was predominately determined by the existence or non-existence of flow that was being traced. In

addition, manhole inspections could indicate that groundwater leaking into the manholes were the source of dry weather flow. Field crews also identified any segments where there was a substantial change in quality or bacterial levels between manholes and targeted these for the next level of investigation.

- Field staff conducted a windshield survey of all nearby buildings, yards, tanks etc. for any and all potential sources of the illicit discharge. If the probable location is easily identifiable, the field staff then performs an onsite inspection of that location. If necessary and permissible, dye testing (see below) could be performed at the site to confirm any illicit connection. Field crews also inspected all catchbasins connected to the affected pipe segment to determine if the catch basins were leaking and/or had unauthorized material in them.
- When the potential illicit discharge source was identified to a particular segment (s) of pipe, and a windshield/field survey of potential sources did not identify any obvious sources, the city completed closed circuit television inspection (CCTV) of the pipe segments in question. The CCTV inspections tapes were used to identify any leaking pipe joints, tapped connections into the pipe and failing pipe that could show potential evidence of the contamination.
- If the pipe segment CCTV inspection did not identify explicit connections to the pipe, the city will review sewer system maps to see if any of the sewers were either in close proximity and/or crossed the drainage system. In these cases, the city also CCTV'ed the sewer segments to confirm sewer pipe conditions (to determine if there was exfiltration from the sewer into the drain). If necessary, the city will conduct the CCTV inspection within particular segments with a sewer plug to stop the upstream sewerage flow so the pipe invert is visible to see any defects.
- If the CCTV inspections identifies particular connections to the pipe segment, the city would conduct dye testing to confirm the connection to the drain.
- If a probable location cannot be easily established, then the affected pipeline could be smoke tested to identify all potential underground connections to vents, yard drains, gutters, foundation drains etc. that show evidence of escaping smoke would be noted. These locations will then need to be individually investigated to determine if they could be the source of the illicit discharge.
- For some areas, the city may find that there is evidence of animal feces contributing to the bacteria levels. For instance, in some previous cases, pet feces have been placed in city catch basins, by residents, causing high bacteria levels and/or animals have actually been found living in the pipes. In these cases, the city will conduct Pharmaceuticals and Personal Care Product (PPCP) testing to determine if there are potential potable water/sanitary service connections. PPCP testing is used as one approach to eliminate the possibility of human pathogens versus speciation testing, which is significantly more expensive.
- If all investigations lead to inconclusive results, then continued and more advanced drain/structure monitoring maybe required, on an intermittent basis. This approach is typically more time consuming and will likely require the sandbagging and overnight damming of flow, for testing the next day. This approach is helpful if the source is intermittent or possibly conscious dumping related to an unknown illegal discharge source. All notes and documentation will be analyzed after the monitoring time period has ceased to determine how

to best continue investigation.

5.5 Eliminating the Sources of Illicit Connections

Once an illicit discharge has been identified, Haverhill will determine who is responsible for the removal of the discharge on a case by case basis. Generally, responsibilities for the repair are as follows:

- **Internal Plumbing Connection** - Generally, it is the building owner's responsibility.
- **Service Lateral** – The city will verify if there was a permit issued by the city to connect into this pipe. If the city approved the connection, the city will pay for the cost of removal. If not, then the home owner will be responsible for all costs.
- **Infrastructure Failure:** This type of discharge is the city's responsibility if within the dedicated right of way.
- **Transitory Discharge:** Again, the building owner is responsible to correct if the building is the cause.

The timeframe for the repair of these illicit discharges is established in the city's stormwater ordinance and will be discussed in the city's future enforcement procedures.

5.6 Confirmation of Illicit Discharge Removal

Once the illicit discharge(s) is removed, the removal should be confirmed by dye testing, smoke testing, or CCTV inspections. After it is confirmed that the illicit discharge(s) has been removed, the outfall, and potentially portions of the tributary area, must be re-inspected. If dry weather flow is present, this flow must be sampled to determine bacteria concentrations. If high, the investigations would continue to identify any other unanticipated connections.

If completing the top down investigative approach, after completing the removal of illicit discharges from a subdrainage area and before beginning the investigation of downstream areas, the subdrainage area would likely be re-inspected to verify corrections. Depending on the extent and timing of corrections, verification monitoring can be done at the initial junction manhole or the closet downstream manhole to each correction. Verification is accomplished by using the same visual inspection, field monitoring, and damming techniques as described above.

Section 6

Evaluation of Detection and Elimination Program

As part of a successful IDDE program, the USEPA recommends that the program include procedures for evaluation and refinement of the techniques, methods, and strategies used. The city will evaluate its IDDE program at the end of each implementation year to assess if it has been effective and most of all, efficient. Program evaluation is the time to step back, look at what has been done, determine what worked and what did not, and make adjustments to plan how future actions can be more effective and efficient.

Field documentation and in-house record keeping are crucial in evaluating the actions taken to locate and eliminate illicit discharges. Such documentation includes but is not limited to, numbers of upstream drain structures screened, public complaints taken, feet of storm sewers videotaped, numbers of discharges eliminated, and number of dye or smoke tests conducted.

Determining the impacts of these actions is more of a challenge but it is important to assess such documentation to determine if any adjustments to the program procedures are needed. Some steps for assessing the effectiveness of the city's IDDE strategies include:

- Evaluating the number of possible illicit discharges that were detected using different methods to aid in determining which detection methods are most effective.
- Evaluating the number of discharges eliminated using different possible enforcement and compliance measures.
- Program evaluation will also include procedures for considering efficiency and feasibility.

A manageable way to determine the success of the city's IDDE program is to answer some of the following questions

- How many illicit sources were identified and eliminated?
- How much staff time and expense did it take to achieve a given result?
- Were practical difficulties encountered with any of the approaches? What were they, and how much of a problem did they present?
- Is the program overall cost effective? What aspects of the program had the highest quality of effectiveness in relationship to cost?
- What techniques were used most often and how successful were they?

Accurately and honestly answering these questions and assessing their importance will help to better the program for future executions.

Section 7

Corrective Actions/Enforcement

7.1 Purpose

Chapter 208 of the City Code prohibits the discharge of pollutants to the city's stormwater system by illicit discharges, illicit connections, or illegal dumping activities. Specifically,

“ The Deputy DPW Director may suspend MS4 access to any person or property without prior written notice when such suspension is necessary to stop an actual or threatened discharge of pollutants that presents imminent risk of harm to the public health, safety, welfare or the environment. In the event any person fails to comply with an emergency suspension order, the Superintendent may take all reasonable steps to prevent or minimize harm to the public health, safety, welfare or the environment. ” (§ 208-29-4)

The city is performing comprehensive stormwater system outfall and piping investigations to identify direct and indirect illicit discharges to the drainage system. In addition, city staff will be trained annually and public education will be used to increase overall awareness of illicit discharges and to use staff and the public help to identify illegal dumping activities, especially those that results in the discharge of pollutants to the stormwater system.

As these illicit stormwater system discharges (and illegal dumping into catch basins or drain manholes) are identified, the city will determine whether the illicit discharge is a result of city work or private/public activities.

This section describes the corrective/enforcement actions that will be used by the city to address public/private-property illicit discharges. These are intended to be progressive enforcement actions to educate the public and to eliminate the illicit discharge. Corrective actions will focus first on education to promote voluntary compliance and escalate to increasingly severe enforcement actions if voluntary compliance is not obtained.

The Director of Public Works or the authorized deputy or representative will use judgment in exercising the right mix of compliance assistance and enforcement to correct identified problems. The city may immediately levy fines if the violation is found to be willful, intentional or egregious.

7.2 Discharge Prohibitions and Restrictions Applicable to the Stormwater System

7.2.1 Prohibited Activities

- A. **Illicit Discharges.** No person shall dump, discharge, cause or allow to be discharged any pollutant or non-stormwater discharge into the MS4 or into the waters of the United States or the Commonwealth of Massachusetts.
- B. **Illicit Connections.** No person shall construct, use, allow, maintain or continue any illicit connection to the MS4, regardless of whether the connection was permissible under applicable law, regulation or custom at the time of connection.

7.2.2 Exempted Activities

The City Code identifies the stormwater system discharges, if occurring, that would be exempted from the enforcement action. These are also listed in Section 2.2 of this Manual. The Superintendent may modify this list if it is determined that any of these discharges contribute an adverse level of pollution that must be curtailed to protect public health, safety, and welfare, and the environment.

7.2.1 Potential Pollutants

Examples of potential pollutants, as defined in the City Code, include, but are not limited to:

- A. Paints, varnishes, and solvents;
- B. Oil and other automotive fluids;
- C. Non-hazardous liquid and solid wastes and yard wastes;
- D. Refuse, rubbish, garbage, litter, or other discarded or abandoned objects, ordnances, accumulations, and floatables;
- E. Pesticides, herbicides, and fertilizers;
- F. Hazardous materials and wastes, including medical wastes, chemical wastes, biological materials, radioactive materials;
- G. Sewage, fecal coliform, and pathogens;
- H. Dissolved and particulate metals;
- I. Animal wastes;
- J. Rock, sand, salt, soils;
- K. Construction wastes and residues;
- L. Noxious or offensive matter of any kind; and
- M. Certain characteristics of wastewater (e.g., pH, temperature, TSS, turbidity, color, BOD, COD, toxicity, or odor).

7.3 Notification and Compliance

7.3.1 Notification

Whenever the *Deputy DPW Director* finds that a person has violated a prohibition or failed to meet a requirement of this ordinance, the Superintendent may order compliance by written notice of violation to the responsible person. If the Superintendent determines that abatement or remediation of contamination or of adverse impacts is required, the notice shall set forth a deadline by which such abatement or remediation must be completed.

7.3.2 Voluntary Compliance

The city's 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 to verify compliance. Field staff should also provide the property operator with an educational brochure describing illicit discharge violations and a copy of city of Haverhill's education material. Field staff should also remind property owners of their obligation to report discharges to the proper agencies.

When voluntary compliance does not produce the desired result, the Superintendent is required to pursue follow-up enforcement action for Non-Criminal Disposition (Chapter 208-64). Table 7-1 outline the detailed enforcement steps. More serious violations or continued non-compliance may warrant a more aggressive, enforcement-oriented approach with criminal penalties.

Table 7-1 Illicit Discharge Enforcement Steps

Enforcement Step	Details
Step 1 – Initial Actions	• Provide educational materials • Encourage voluntary compliance • Provide written warning letter identifying issues and setting expected compliance date for the elimination of the illicit activity • If resolved, require evidence of corrected problem (if applicable) • Site visit to verify compliance
Step 2 – Follow-up Actions	• Send “Second Violation” letter to property owner regarding unresolved issues and fine of \$100. • If further unresolved, Send “Third Violation” Letter to property owner regarding unresolved issue and fine of \$200 • If continuing unresolved, Send “Fourth Violation” Letter and fine of \$300.
Step 3 – Final Actions	• City may correct problems and send bill to property owner • City may refer the issue for criminal prosecution.

7.3.3 Compliance Approach

Operational Problems/Illegal Dumping

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 (such as informing the property owner or person of the city's hazardous waste collection days), the city can provide technical assistance to aid property owners in identifying the required modifications to eliminate the illegal discharges.

Structural Problems

Many 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 if no city permit exists. The city shall notify the property owner that no permits exist that verifies the found illicit connection. Upon notification, the property shall have 60-days to remove the documented illicit connection. If said illicit connection is not resolved then the city shall correct the illicit connection and place a lien on the property owner's property until payment is received.

7.3.4 Confirmation and/or Performance by the City

The city will confirm that the structural modification was made to eliminate the illicit discharge.

During the notification process, the property owner will be duly notified that if they fail to abate or perform remediation within the specified deadline, the city may, at its option, undertake such work, and expenses thereof shall be charged to the property owner. Within thirty (30) days after completion by the city of all measures necessary to abate the violation or to perform remediation, the property owner will be notified of the costs incurred by the city, including administrative costs.

The property owner may file a written protest objecting to the amount or basis of costs with the Superintendent within thirty (30) days of receipt of the notification of the costs incurred. If the amount due is not received by the expiration of the time in which to file a protest or within thirty (30) days following a decision of the Superintendent affirming or reducing the costs, or from a final decision of a court of competent jurisdiction, the costs shall become a special assessment against the property owner and shall constitute a lien on the owner's property for the amount of said costs. Interest shall begin to accrue on any unpaid costs at the statutory rate provided in G.L. c. 59, § 57 after the thirty-first day at which the costs first become due.

7.4 Penalties

The City Code identifies the different penalties that may be incurred by private property owners or the public if found to be the cause of an illicit discharge to the stormwater system including:

- **Civil Relief.** If a person violates the provisions of this ordinance, its resulting regulations, or any permit, notice, or order issued thereunder, the Superintendent may seek injunctive relief in a court of competent jurisdiction restraining the person from activities which would create further violations or compel the person to perform abatement or remediation of the violation. Pursuant to G.L. c. 83, § 10, the Superintendent may also levy a civil penalty of not more than

\$5,000 per violation. Each day or part thereof that such violation occurs or continues shall constitute a separate offense.

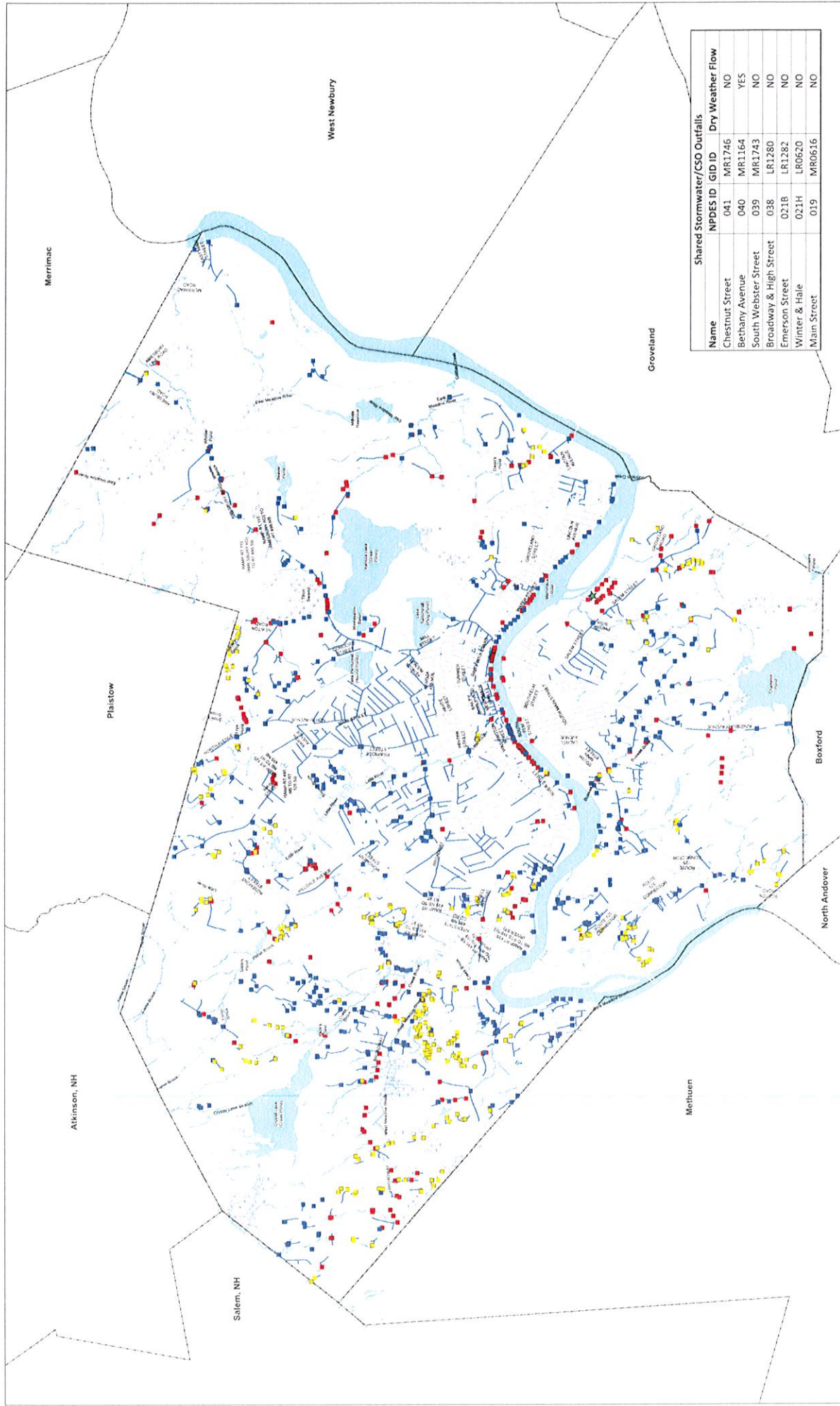
- **Termination of Service Upon Imminent Endangerment.** In instances where any discharge presents imminent endangerment to the health or welfare of persons, the Superintendent may immediately terminate service.
An actual or threatened discharge to the MS4 that violates or would violate this chapter is hereby declared to be a nuisance. A line conveying sewage or designed to convey sewage that is connected to the MS4 is hereby declared to be a nuisance.
- **Criminal Penalty.** Any person who violates any provision of this ordinance, its resulting regulations, or any permit, notice, or order issued thereunder, shall be punished by a fine of not more than \$5,000. Each day or part thereof that such violation occurs or continues shall constitute a separate offense.
- **Non-Criminal Disposition.** As an alternative to criminal prosecution, the City may elect to utilize the noncriminal disposition procedure set forth in G.L. c. 40, § 21D and adopted by the City as a general ordinance in which case the Superintendent shall be the enforcing person. The penalty for the first violation shall be a written warning. The penalty for the second violation shall be \$100. The penalty for the third violation shall be \$200. The penalty for the fourth and subsequent offenses shall be \$300. Each day or part thereof that such violation occurs or continues shall constitute a separate offense.

7.5 Record Keeping

Effective enforcement procedures require comprehensive recordkeeping and documentation to show that all program steps have been followed. Throughout the problem investigation and corrective action activities, all information related to the incident or property in question will be documented by the city in the case log.

Appendix A

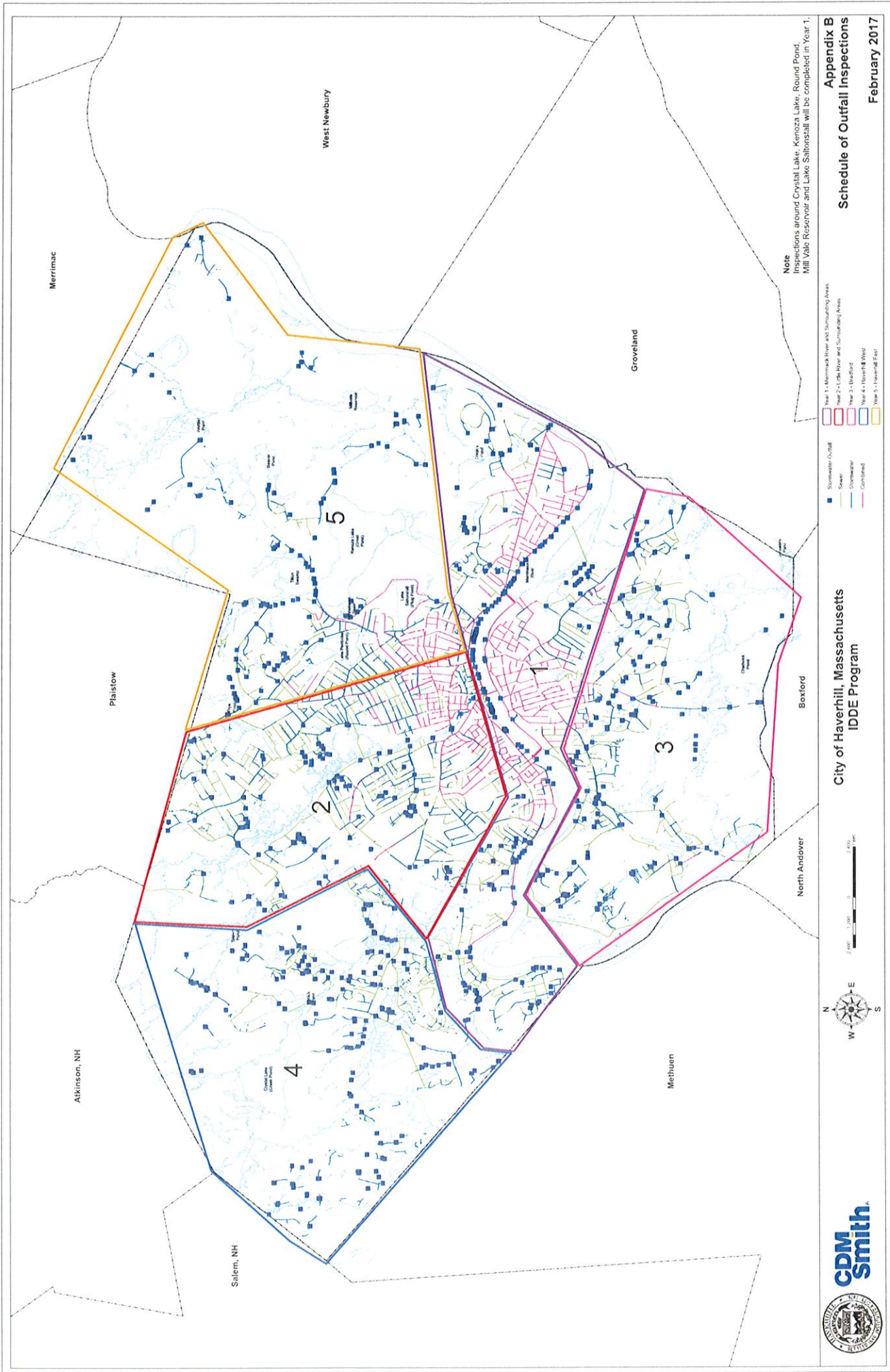
City Of Haverhill Stormwater System Map



Shared Stormwater/CSO Outfalls			
Name	NPDES ID	GID ID	Dry Weather Flow
Chestnut Street	041	MR1746	NO
Bethany Avenue	040	MR1164	YES
South Webster Street	039	MR1743	NO
Broadway & High Street	038	LR1280	NO
Emerson Street	0218	LR1282	NO
Winter & Hale	021H	LR0620	NO
Main Street	019	MR0616	NO

Appendix B

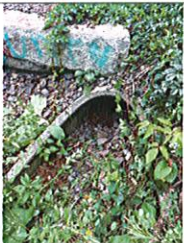
Stormwater Outfall Inspections - Schedule of Priority Areas



Appendix C

Stormwater Outfall Inspection Form

Haverhill IDDE Investigation & Inspection Form Outfall

SECTION 1: BACKGROUND DATA							
ASSET ID:		R1102		OUTFALL ID:		R1102	
Date/Time:		2020-08-27 8:45:00					
Temperature: °F		59		Inspector(s):		James Conte Jesse Middleton Zebulan Day	
Street Name/Structure Location:		Cross Country					
Previous Precipitation Date/End Time:				Amount (Inches):			
Pictures							
SECTION 2: OUTFALL PIPE ASSET DESCRIPTION							
Location	Upstream Asset ID	Material		Shape	Diameter/Dimension (in.)	Submerged	
Outfall Pipe	DMI-358	Reinforced Concrete		Circle	24	In Water:	No
						With Sediment:	No
SECTION 3: OUTFALL PIPE PHYSICAL INDICATORS							
Indicator		Indicator Present?		Indicator Description			
Asset Damage		None					
Deposits/Stains		None					
Pool Quality		None					
Pipe Algae/Growth		None					
*Do physical indicators suggest an illicit discharge is present (Y/N):		No					
Is Inlet Pipe No.1 Flowing?		No		Estimated GPM:			
SECTION 4: OUTFALL PIPE PHYSICAL INDICATORS (ALL FLOWING ASSETS)							
Indicator	Indicator Present (Yes/No)		Description		Severity		
Odor							
Color							
Turbidity							
Floatables (Does Not Include Trash)							
SECTION 5: OUTFALL PIPE SAMPLING/TESTING RESULTS (ALL FLOWING ASSETS)							
Sample Date/Time:							
Parameter	Result		Typical EPA Benchmarks		Equipment		
Temperature (degrees F)					Hanna portable PH and Temp meter		
pH					Hanna portable PH and Temp meter		
Specific Conductivity (uS)					To be sent to lab or: EXTECH EC500		
Salinity (ppm S)					EXTECH EC500		
Chlorine (ppm)			≥ Reporting Limit		Hach pocket Colorimeter		
Ammonia (mg/L)			≥ 0.5 mg/L		To be sent to lab		
Surfactants (mg/L)			≥ 0.25 mg/L		To be sent to Lab or Hanna Instruments HI96769C		
E.coli (cfu/100mL)			> 235 cfu/100mL		To be sent to lab		
Enterococcus (cfu/100mL)			> 61 cfu/100mL		To be sent to lab		
Phosphorus (mg/L)					To be sent to lab		
Comments: Riprap from around outfall has fallen in.							
Signature of Inspector:	  						

Appendix D

Stormwater Outfall Inspection and Sampling Procedures

EPA New England Stormwater Outfall Sampling Protocol

Draft - April 2011

Purpose

This document provides a common framework for EPA New England (“EPA-NE”) staff to develop and implement stormwater outfall sampling events, and provides a recommended approach to State and local watershed association personnel. Adopted from Boston Water and Sewer Commission (“BWSC”) (2004), Pitt (2004), and based upon fieldwork conducted and data collected by EPA-NE, the protocol relies primarily on visual observations and the use of field test kits and portable instrumentation during dry and wet weather to complete a screening-level investigation of stormwater outfall discharges or flows within the drainage system. When necessary, the addition of more conclusive chemical markers may be included. The protocol is applicable to most typical Municipal Separate Storm Sewer Systems (“MS4s”) and smaller tributary streams. The smaller the upstream catchment area and/or more concentrated the flow, the greater the likelihood of identifying an upstream wastewater source.

Introduction

The protocol is structured into several phases of work that progress logically through elements of investigation planning and design, laboratory coordination, sample collection, and data evaluation. The protocol involves the concurrent collection and analyses of water samples for surfactants, ammonia, total chlorine, and bacteria. When more precise confirmation regarding the presence or absence of human sanitary sewage is necessary, and laboratory capacity is available, the additional concurrent collection of Pharmaceutical and Personal Care Product (“PPCP”) samples is advised. When presented with a medium to large watershed or numerous stormwater outfalls, the recommended protocol is the screening of all outfalls using the surfactant, ammonia, total chlorine, and bacterial analyses, and using the resulting data to prioritize and sample a subset of outfalls for all parameters, including PPCP compounds and additional analyses as appropriate. Ideally, screening-level analyses can be conducted by state, municipal, or local watershed association personnel, and a prioritized sub-set of outfalls can be sampled by EPA-NE using more advanced confirmatory techniques.

Step I – Reconnaissance and Investigation Design

Each sample event should be designed to answer a specific problem statement and work to identify the source of contamination. Any relevant data or reports from State, municipal, or local watershed associations should be reviewed when selecting sample locations. Aerial photography, mapping services, or satellite imagery resources are available free to the public through the internet, and offer an ideal way to pre-select locations for either field verification or sampling.

Sample locations should be selected to segregate outfall sub-catchment areas or surface waters into meaningful sections. A common investigative approach would be the identification of a specific reach of a surface water body that is known to be impaired for bacteria. Within this

specific reach, stormwater outfalls and smaller tributary streams would be identified by desktop reconnaissance, municipal outfall mapping, and field investigation when necessary. Priority outfalls or areas to field verify the presence of outfalls should be selected based on a number of factors, including but not limited to the following: those areas with direct discharges to critical or impaired waters (e.g. water supplies, swimming beaches); areas served by common/twin-invert manholes or underdrains; areas with inadequate levels of sanitary sewer service, Sanitary Sewer Overflows (“SSOs”), or the subject of numerous/chronic sanitary sewer customer complaints; formerly combined sewer areas that have been separated; culverted streams, and; outfalls in densely populated areas with older infrastructure. Pitt (2004) provides additional detailed guidance.

When investigating an area for the first time, the examination of outfalls in dry-weather is recommended to identify those with dry-weather flow, odor, and the presence of white or gray filamentous bacterial growth that is common (but not exclusively present) in outfalls contaminated with sanitary sewage (see Attachment 1 for examples). For those outfalls with dry-weather flow and no obvious signs of contamination, one should never assume the discharge is uncontaminated. Sampling by EPA-NE staff has identified a number of outfalls with clear, odorless discharges that upon sampling and analyses were quite contaminated. Local physical and chemical conditions, in addition to the numerous causes of illicit discharges, create outfall discharges that can be quite variable in appearance. Outfalls with no dry-weather flow should be documented, and examined for staining or the presence of any obvious signs of past wastewater discharges downstream of the outfall.

As discussed in BWSC (2004), the protocol may be used to sample discreet portions of an MS4 sub-catchment area by collecting samples from selected junction manholes within the stormwater system. This protocol expands on the BWSC process and recommends the concurrent collection of bacteria, surfactant, ammonia, and chlorine samples at each location to better identify and prioritize contributing sources of illicit discharges, and the collection of PPCP compounds when a more conclusive source verification is necessary.

Finally, as discussed further in Step IV, application of this sampling protocol in wet-weather is recommended for most outfalls, as wet-weather sampling data may indicate a number of illicit discharge situations that may not be identified in dry weather.

Step II – Laboratory Coordination

All sampling will be conducted in accordance with an approved EPA Quality Assurance Project Plan (“QAPP”). A model QAPP is included as Attachment 2. While the QAPP details sample collection, preservation, and quality control requirements, detailed coordination with the appropriate laboratory staff will be necessary. Often sample events will need to be scheduled well in advance. In addition, the sampling team must be aware of the strict holding time requirements for bacterial samples – typically samples analysis must begin within 6 hours of sample collection. For sample analyses conducted by a commercial laboratory, appropriate coordination must occur to determine each facilities respective procedures and requirements.

Currently, the EPA-NE laboratory has a limited capacity for PPCP sampling, and any proposed PPCP sample events must be coordinated with the appropriate staff.

Step III – Sample Collection

Once those outfalls with dry-weather flow have been identified, concurrent sampling and analyses for surfactants, ammonia, and total chlorine (which can all be done through the use of field kits), in addition to bacteria (via laboratory analysis) should be conducted. When numerous outfalls with dry-weather flow exist, sample locations should be prioritized according to the criteria mentioned above. In addition, field screening using only the field kits may occur during the field reconnaissance. However, it must be emphasized that the concurrent sampling and analyses of bacteria, surfactant, ammonia, and total chlorine parameters is the most efficient and cost-effective screening method.

When first observed, the physical attributes of each outfall or sampling location should be noted for construction materials, size, flow volume, odor, and all other characteristics listed on the data collection form (Attachment 3). In addition, GPS coordinates should be collected and a photograph of the sample location taken. Whenever possible, the sampling of storm drain outfalls should be conducted as close to the outfall opening as possible. Bacterial samples should be collected first, with care to not disturb sediment materials or collect surface debris/scum as best possible. A separate bottle is used to collect a single water sample from which aliquots will be analyzed for surfactants, ammonia, and total chlorine. A sample for PPCP analysis is recommended to be collected last, as the larger volume required and larger bottle size may cause some sediment disturbance in smaller outfalls or streams. If necessary, a second smaller, sterile and pre-cleaned sampling bottle may be used to collect the surface water which can then be poured into the larger PPCP bottle. Last, a properly calibrated temperature/specific conductance/salinity meter should be used to record all three parameters directly from the stream or outfall. When flow volume or depth is insufficient to immerse the meter probe, a clean sample bottle may be utilized to collect a sufficient volume of water to immerse the probe. In such instances, meter readings should be taken immediately.

As soon as reasonably possible, sample aliquots from the field kit bottle should be analyzed. When concurrent analyses are not possible, ammonia and chlorine samples should be processed first, followed by surfactants analysis, according to each respective Standard Operating Procedures contained in Attachments 4, 5, and 6, or as appropriate based on the particular brand and type of field test kit being used. All waste from the field test kits should be retained and disposed of according to manufacture instructions. Results should be recorded, samples placed in a cooler on ice, and staff should proceed to the next sample location.

Upon completion of sampling and return to the laboratory, all samples will be turned over to the appropriate sample custodian(s) and accompanied by an appropriate Chain-of-Custody ("COC") form (an example form is included in Attachment 7).

Step IV – Data Evaluation

Bacterial results should be compared to the applicable water quality standards. Surfactant and ammonia concentrations should be compared to the thresholds listed in Table 1. Evaluation of the data should include a review for potential positive results due to sources other than human wastewater, and for false negative results due to chemical action or interferences. In the EPA-NE region, field sampling has indicated that the biological breakdown of organic material in historically filled tidal wetlands may cause elevated ammonia readings, as can the discharge from many landfills. In addition, salinity levels greater than 1 part per thousand may cause elevated surfactant readings, the presence of oil may likewise indicate elevated levels, and fine suspended particulate matter may cause inconclusive surfactant readings (for example, the indicator ampule may turn green instead of a shade of blue). Finally, elevated chlorine from leaking drinking water infrastructure or contained in the illicit wastewater discharge may inhibit bacterial growth and cause very low bacterial concentrations. Any detection of total chlorine above the instrument Reporting Limit should be noted.

Table 1 – Freshwater Water Quality Criteria, Threshold Levels, and Example Instrumentation¹

Analyte/ Indicator	Threshold Levels/ Single Sample ³	Instrumentation
E. coli ²	235 cfu/100ml	Laboratory via approved method
Enterococci ²	61 cfu/100ml	Laboratory via approved method
Surfactants (as MBAS)	≥ 0.25 mg/l	MBAS Test Kit (e.g. CHEMetrics K-9400)
Ammonia (NH ₃)	≥ 0.5 mg/l	Ammonia Test Strips (e.g. Hach brand)
Chlorine	> Reporting Limit	Field Meter (e.g. Hach Pocket Colorimeter II)
Temperature	≥83°F(28.3°C) and change 5°C(2.8°C) in rivers ²	Temperature/Conductivity/Salinity Meter (e.g. YSI Model 30)

¹ The mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. EPA

² 314 CMR 4.00 MA - Surface Water Quality Standards - Class B Waters.

³ Levels that may be indicative of potential wastewater or washwater contamination

Once dry-weather data has been examined and compared to the appropriate threshold values, outfalls or more discreet reaches of surface water can be selected for sampling or further investigation. Wet-weather sampling is also recommended for all outfalls, in particular for those that did not have flow in dry weather or those with dry-weather flow that passed screening thresholds. Wet-weather sampling will identify a number of situations that would otherwise pass unnoticed in dry weather. These wet-weather situations include, but are not limited to the following: elevated groundwater that can now cause an exchange of wastewater between cracked or broken sanitary sewers, failed septic systems, underdrains, and storm drains; increased sewer

volume that can exfiltrate through cracks in the sanitary piping; increased sewer volume that can enter the storm drain system in common manholes or directly-piped connections to storm drains; areas subject to capacity-related SSO discharges, and; illicit connections that are not carried through the storm drain system in dry-weather.

Step V – Costs

Use of field test kits and field instruments for a majority of the analytical parameters allows for a significantly reduced analytical cost. Estimated instrument costs and pro-rated costs per 100 samples are included in Table 2. The cost per 100 samples metric allows averaged costs to account for reagent refills that are typically less expensive as they do not include the instrument cost, and to average out the initial capital cost for an instrument such as a temperature/conductivity/salinity meter. For such capital costs as the meters, the cost over time will continue to decrease.

Table 2 – Estimated Field Screening Analytical Costs ¹

Analyte/ Indicator	Instrument or Meter ²	Instrument or Meter Cost/No. of Samples	Cost per Sample (Based on 100 Samples) ³
Surfactants (as MBAS)	Chemetrics K- 9400	\$77.35/20 samples (\$58.08/20 sample refill)	\$3.09
Ammonia (NH ₃)	Hach brand 0 – 6 mg/l	\$18.59/25 samples	\$0.74
Total Chlorine	Hach Pocket Colorimeter II	\$389/100 samples (\$21.89 per 100 sample refill)	\$3.89
Temperature/ Conductivity/ Salinity	YSI	\$490 (meter and cable probe)	\$4.90

¹ Estimated costs as of February 2011

² The mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. EPA

³ One-time meter costs and/or refill kits will reduce sample costs over time

From Table 2, the field analytical cost is approximately \$13 per outfall. Typical bacterial analyses costs can vary depending on the analyte, method, and total number of samples to be performed by the laboratory. These bacterial analyses costs can range from \$20 to \$60. Therefore, the analytical cost for a single outfall, based on the cost per 100 samples, ranges from \$33 to \$73. As indicated above, these costs will decrease slightly over time due to one-time capitals costs for the chlorine and temperature/conductivity/salinity meters.

Step VI – Follow-Up

Once all laboratory data has been reviewed and determined final in accordance with appropriate quality assurance controls, results should be reviewed with appropriate EPA staff to determine next steps. Those outfalls or surface water segments that fail to meet the appropriate water quality standard, and meet or exceed the surfactant and ammonia threshold values, in the absence of potential interferences mentioned in Step IV, indicate a high likelihood for the presence of illicit connections upstream in the drainage system or surface water. Whereas illicit discharges are quite variable in nature, the exceedance of the applicable water quality standard and only the ammonia or surfactant threshold value may well indicate the presence of an illicit connection. When available, the concurrent collection and analyses of PPCP data can greatly assist in confirming the presence of human wastewater. However, such data will not be available in all instances, and the collective data set and information regarding the physical characteristics of each sub-catchment or surface water reach should be used to prioritize outfalls for further investigation. As warranted, data may be released to municipal representatives, and should be accompanied by an explanation of preliminary findings. Release of such data should be fully discussed with the case team or other appropriate EPA staff.

References Cited

Boston Water & Sewer Commission, 2004, *A systematic Methodology for the Identification and Remediation of Illegal Connections*. 2003 Stormwater Management Report, chap. 2.1.

Pitt, R. 2004 *Methods for Detection of Inappropriate Discharge to Storm Drain Systems*. Internal Project Files. Tuscaloosa, AL, in The Center for Watershed Protection and Pitt, R., *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments*: Cooperative Agreement X82907801-0, U.S. Environmental Protection Agency, variously paged. Available at: <http://www.cwp.org>.

Instrumentation Cited (Manufacturer URLs)

MBAS Test Kit - CHEMetrics K-9400: <http://www.chemetrics.com/Products/Deterg.htm>

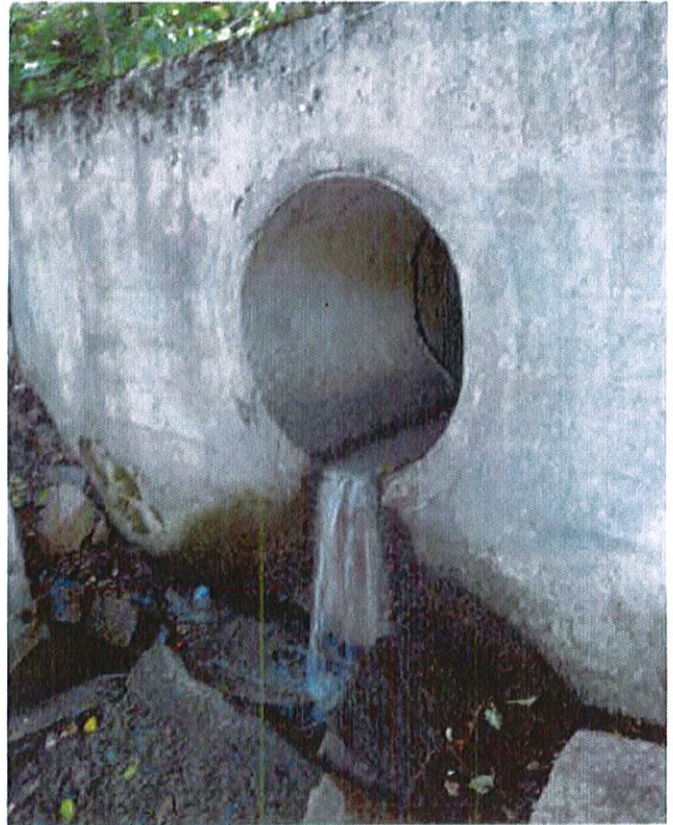
Portable Colorimeter – Hach Pocket Colorimeter II: <http://www.hach.com/>

Ammonia (Nitrogen) Test Strips: <http://www.hach.com/>

Portable Temperature/Conductivity/Salinity Meter: YSI Model 30:
<http://www.ysi.com/productsdetail.php?30-28>

Disclaimer: *The mention of trade names or commercial products in this protocol does not constitute endorsement or recommendation for use by the U.S. EPA.*

EPA NE Stormwater Outfall Sampling Protocol – Attachment 1
Stormwater Outfalls With Indicators of Illicit Discharges



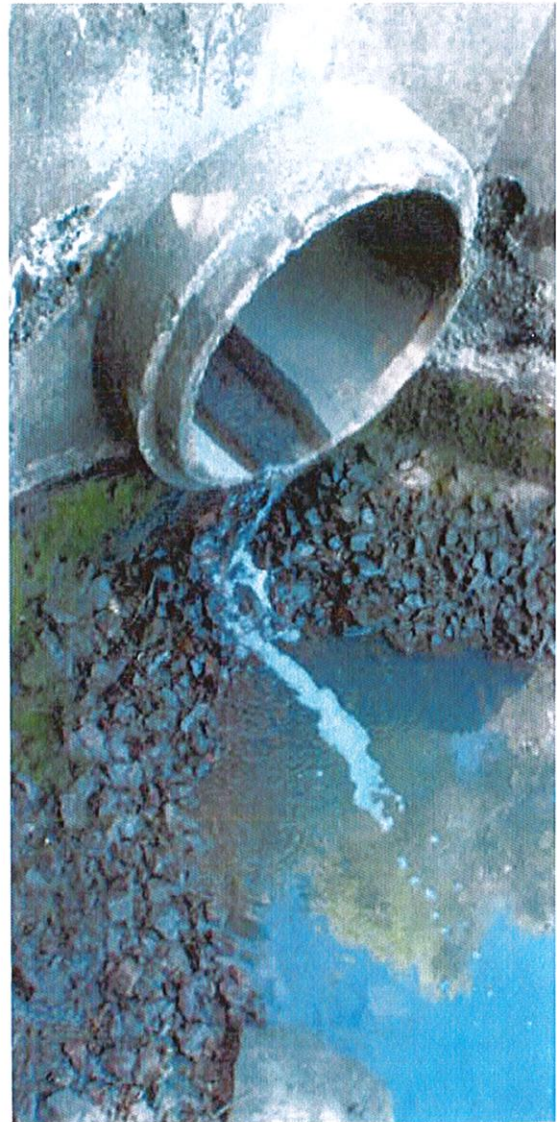
Note white, gray, or off-white filamentous bacterial growth



EPA NE Stormwater Outfall Sampling Protocol – Attachment 1
Stormwater Outfalls With Indicators of Illicit Discharges



Note off-white filamentous bacterial growth



Note gray bacterial growth, suds, cloudy a

**Stormwater Monitoring Quality Assurance Project Plan
2011-2016**

RFA #

Sampling Plan Acceptance

EPA OES Enforcement and Project Manager/Coordinator Signature:	 Date:
EPA OEME Project Managers/Coordinator Signature:	 Date:
EPA OEME QA Officer Charlie Porfert Signature:	 Date:
EPA Chemistry Team Lead Dan Boudreau Signature:	 Date:

1.0 Background

U.S. EPA Administrative Order 5360.1 requires that “all projects involving environmental monitoring performed by or for the U.S. EPA shall not be undertaken without an adequate Quality Assurance Project Plan (QAPP).” The purpose of this document is to describe the process used to develop, select, manage, and finalize stormwater monitoring projects. In describing this process, quality assurance goals and methods will be established, thus ensuring that the overall program and each monitoring project will meet or exceed EPA requirements for quality assurance.

The objective of these projects will be to collect data that is usable by EPA OES enforcement staff for enforcement actions and information requests. The primary focus of this project will be on urban water stormwater outfalls in the New England Region watersheds.

2.0 Sampling overview

Monitoring will be conducted on pre-scheduled days with the Laboratory. Samples will be retrieved from surface water, in stream or outfalls at suspected hotspots or areas that need further delineation. Sample sites will be located using GPS, with an accuracy goal of ± 1 meter and PDOP less than 6. Less accurate GPS reading or coordinates from maps will be accepted when site or other conditions do not allow ± 1 meter accuracy.

The primary focus of this sampling will be used to identify illegal discharges.

Results from the sampling will be used by EPA enforcement staff for enforcement purposes. For this project, sampling will be conducted according to EPA's Ambient Water Sampling SOP (Table 3). Volunteers and watershed association staff may assist in sampling. All procedures will be followed that are specified in Table 3. Parameter to be sampled will be predetermined by enforcement (OES) and OEME staff, based on data needs.

A. Locations

Site locations will be determined from field or desktop reconnaissance by project staff. Sample analyses will be predetermined based on conditions known about the sampling location prior to sampling. These may include data from previous sampling or from data collected from Mass DEP or local watershed associations. Any of the parameters listed in table 2 may be analyzed.

B. Analytical Methods and Reporting limits

Sample analyses will be conducted by EPA Laboratories.

This effort will test and compare the most appropriate analytical methods including, but not limited to; laboratory analysis, test kits and field analysis to determine the most effective and cost-efficient outfall and in-stream sampling approach.

Multiple and repeated testing will occur at each location to compare different method for identifying sewage contamination.

PPCPs, E.coli and enterococcus will be analyzed by EPA's Laboratory. Surfactants, ammonia, total chlorine will be analyzed with field test kits. Potential additional laboratory analyses include nitrogen (nitrate/nitrite), TSS, BOD, surfactants, ammonia and TPH. The Laboratory used

for each sampling event will be determined prior to sampling by the OEME Project Manager based on required analyses Laboratory availability and contract funds available.

Where available, a known concentration sample will be used to evaluate the performance of each test method. The known concentration sample will be processed in the field and Laboratory as a routine sample. The analyst or field technician will not know the concentration of the sample prior to analyzing and reporting the sample result. Sampling for PPCP testing will be done using extreme care not to contaminate the sample. No caffeine products should be consumed prior to sampling.

Table 1: Parameter specifications

Parameter (lab - equipment)	Preservation	Holding time
PH	None	Immediate
Temperature	None	Immediate
Sp Cond	None	Immediate
DO	None	Immediate
Total Phosphorus (EPA)	H ₂ SO ₄ (pH <2) + Ice	28 days
TSS (EPA)	Ice	7 days
TSS (Alpha)	Ice	7 days
BOD (Alpha)	Ice	48 hours
Surfactants (Alpha)	Ice	48 hours
Surfactants (field kit – Chemetrics)	None	Immediate
Ammonia (alpha)	H ₂ SO ₄ (pH <2) + Ice	28 days
Ammonia (test strips)	None	Immediate
TPH Petroleum ID (alpha)	Ice	7 Days to extraction 40 days after extraction
E. Coli (EPA)	Ice	6 hrs to lab
Enterococcus (EPA)	Ice	6 hrs to lab
PPCP	Ice (acidified in Lab)	7 day to extraction 40 days after extraction
Chlorine (Field kit – Hach)	None	Immediate

Table 2: Analytical References and Quality Control Goals

Parameter (lab- equipment)	Reporting Limits	Water Quality Criteria or Guidelines (MA or EPA)	Quality Assurance Goals		
			Precision	Accuracy	Completeness
PH	4 to 10 units	6.5 - 8.3	0.02 unit	+ 0.3 units	90%
Temperature	0 to +40°C	28.3°C	0.1 °C	+ 0.15°C	90%
Sp Cond	0 to 100 mS/cm	NA	5 uS/cm	+10% cal std (µS/cm)	90%
DO	0.5mg/l to Sat	≥5 mg/l , ≥60% saturation	0.02mg/l	± .5 mg/l	90%
Total Phosphorus (EPA)	5.0 ug/l	NA	Field dup 30% RPD	MS 70-130%	90%
TSS (EPA)	5mg/L	NA	Field dup 30% RPD	See SOP	
TSS (Alpha)	5 mg/L	NA	Field dup 30% RPD	See SOP	90%
BOD (Alpha)	2 mg/L	NA	Field dup 30% RPD	See SOP	90%
Surfactants (field kit – Chemetrics)	0.25 mg/L ¹	0.25 mg/L	Field dup 30% RPD	TBD	90%
Ammonia (test strips)	0.25 mg/L ¹	1.0 mg/L	Field dup 30% RPD	TBD	90%
TPH Petroleum ID (alpha)	Variable	NA	Field dup 30% RPD	See SOP	
E. Coli (EPA)	4 col./ 100 ml	≤126 col./100 ml* ≤ 235 col./100 ml	+100 col/100ml or 30% RPD	N/A	90%
Enterococcus (EPA)	1 col/100ml	≤33 col./100 ml* ≤ 61 col./100 ml	+100 col/100ml or 30% RPD	See SOP	90%
PPCP	TBD	NA	Field dup 50% RPD	TBD	90%
Chlorine (Field kit – Hach)	0.02 mg/l	NA	Field dup 30% RPD	TBD	90%

Note

*Geometric mean Criteria

TBD = To be determined, Field methods and some colorimeter methods do not have accuracy criteria determined.

¹ Needs field verification to confirm

Table 3: Field and Laboratory References

Parameter	Analytical Method Reference	SOP reference
	Field References- 5/2005	
pH	n/a	ECASOP-YSISondes9
Conductivity		
Temperature		
dissolved oxygen		
Ambient water samples	n/a	ECASop-Ambient Water Sampling2
Chain of custody of samples	n/a	EIASOP-CHAINOFCUST
Sample login, tracking, disposition	n/a	EIASOP-ADMLOG14
	Lab. References- 5/2005	
Total Phosphorus (EPA)	EPA 365.3	EIASOP-INGTP8
TSS (EPA)	EPA 160.2	EIASOP-INGTSS-TDS-VRES5
TSS (Alpha)	EPA 160.2,SM2540D	SOP/07-29
BOD (Alpha)	EPA 405.1,SM5210B	SOP/07-13
Surfactants (field kit – Chemetrics)	Chemetrics	Draft
Ammonia (test strips)	Hach	Draft
TPH Petroleum ID (alpha)	8015B (M)	0-017
E. Coli (EPA)	SM9230	ECASOP- TC/EC Colilert2
Enterococcus (EPA)	SM9230	ECASOP-Enterolert1
PPCP	EPA 1694	TBD
Chlorine (Field kit – Hach)	Hach	TBD

*Specific conductance is the only parameter identified as non critical

Bottle list

Table 4: Bottle Sampling List

Parameter (lab - equipment)	Bottle	Preservation
Primary analyses		
E. Coli (EPA)	(2) 120ml or 250ml sterile	Ice
Enterococcus (EPA)		Ice
PPCP	1 Liter Amber	Ice (acidified in Lab)
Optional analyses		
Chlorine (Alpha)	500 ml	Ice
Total Phosphorus (EPA)	125 ml	H ₂ SO ₄ (pH <2) + Ice
TSS (EPA)	1 liter	Ice
TSS (Alpha)	1 liter	Ice
BOD (Alpha)	1 Liter	Ice
TPH Petroleum ID (alpha)	2 -1 Liter Amber Glass teflon lined	Ice
E. Coli (Alpha)	120 ml sterile	Ice
Enterococcus (Alpha)	120 ml sterile	Ice

C. Quality Control

Calibration:	EPA will calibrate its sondes according to the EPA sonde calibration SOP.
Field duplicate:	One duplicate sample will be collected per sampling event or approximately for every ten samples.
Trip Blank:	OEME Chemist will run appropriate QA samples for PPCP's. One blank sample will be collected for approximately every ten bacteria samples. Reported data that is less than 5 times the trip (field) blank concentration will be flagged.
QC Criteria:	Are specified in table 2, data not meeting this criteria will be reviewed by the Project Manager. Data that does not meet laboratory QA/QC criteria will be flagged by the laboratory.

D. Chain of Custody

Chain of custody procedures will follow the OEME/Investigations Office SOP (Table 3)

3.0 Data Review

EPA Microbiology data will be reviewed by the Biology QAO. Alpha generated microbiology samples will be reviewed by the OEME Project Manager. All field data and draft data reports will be reviewed by the OEME Project manager. Laboratory generated data (from Alpha and EPA) will be reviewed by the Chemistry Team Leader.

4.0 Data reports

Data reports will be reviewed by the Project Coordinator and the OEME Project Manager before a final report is release to the Enforcement Coordinator. Draft reports may be released without a complete review.

5.0 Attachments (Q:\share\RARE\QAPP)

- 1) Standard Operating Procedure Enterococcus (SM9230B), Multiple Tube Technique. SOP/07-01 *Alpha Analytical, Inc. May 28, 2005*
- 2) Standard Operating Procedure E. Coli (SM9213D). SOP/07-41 *Alpha Analytical, Inc. May 28, 2005*
- 3) Standard Operating Procedure MBAS, Ionic Surfactants. Draft SOP *EPA Laboratory. January 28, 2010*
- 4) Standard Operating Procedure Nitrogen Ammonia. Draft SOP *EPA Laboratory. February 10, 2011*
- 5) Standard Operating Procedure Total Chlorine. Draft SOP *EPA Laboratory. February 12, 2010*
- 6) Standard Operating Procedure TSS/ TVSS (SM2540 D, EPA 160.2). SOP/07-29 *Alpha Analytical, Inc. September 29, 2007*
- 7) Standard Operating Procedure BOD-5day, SBOD-5day, and cBOD-5day (SM 5210B, and EPA 405.1). SOP/07-13 *Alpha Analytical, Inc. September 29, 2007*
- 8) Standard Operating Procedure TPH 8015D – Modified 0-017 (EPA 8015D Modified) *Alpha Analytical, Inc. March 04, 2008*
- 9) Standard Operating Procedure determination of Trace Elements in Water and Wastes by Inductively Coupled Plasma- Mass Spectrometry (200.8). SOP/06-11 *Alpha Analytical, Inc. July 13, 200*
- 10) Standard Operating Procedure Inductively Coupled Plasma – Mass Spectrometry (6020). SOP/06-10 *Alpha Analytical, Inc. October 25, 2007*

STORMWATER MONITORING

Field Collection Requirements (To be recorded at each site)

Sample-

Site Name _____

Time collected _____

Date collected _____

Inspection-

****Take picture at site****

Outfall diameter _____ ('na' if open stream)

Flow estimate _____ ('na' if open stream)

Odor _____

Color _____

Turbidity _____

Floatables _____

Other observations _____

YSI Meter (calibrate in lab)-

Salinity _____

Temp _____

Conductivity (give both #'s)

Location information-

Short description of where sample was collected at site _____

GPS _____

Field Kits listed in the order they should be conducted in, include any applicable notes-

NH3 strip _____

Cl2 kit _____

Hach meter - (3 min wait)

Surfactant _____

Chemetrics K-9400 Blue box/detergent test kit

Additional Notes:

(Note any changes in weather conditions) _____

STORMWATER MONITORING (PAGE 2)

Field Equipment List

Waste Containers (2 total – clearly labeled):

- 1 liter amber plastic for surfactants/detergents kit waste
- 1 liter amber plastic for Cl2 kit waste

Sample Bottles (3 total for each sample location)-

- 120ml sterile – E.coli/entero
- 1 Liter amber glass: PPCP, EPA (Peter Philbrook)
- 120ml-250ml plastic – Field Kit Bottle – to be used on site for kits listed above

***Fill out chain of custody

In Carboy Container

- ☐ Log book
- ☐ COC forms
- ☐ Extra sample bottles
- ☐ Colored tape
- ☐ Sharpies
- ☐ Write-On-Rain Pens
- ☐ Paper towels
- ☐ GPS
- ☐ Sampling plan & GPS locations
- ☐ Regular length Powder Free Gloves
- ☐ Squirt bottle of DI Water
- ☐ Coolers with Ice
- ☐ Waders/Boots
- ☐ YSI multi parameter Meter

ENVIRONMENTAL PROTECTION AGENCY

REGION 1

CHAIN OF CUSTODY RECORD

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Stormwater Outfall Dry-Weather Flow Sample Collection/Field Analysis Procedures

This document outlines the procedures to be followed prior to inspecting stormwater outfalls in order to ensure that they are inspected properly and that dry-weather flow samples, and any laboratory samples for follow up tests, are done appropriately.

Pre-Inspection Procedures

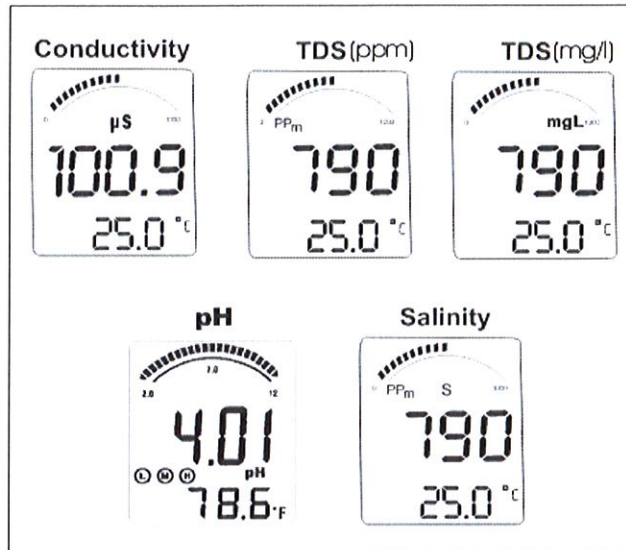
1. Before beginning outfall inspections, check that the following equipment is available and ready for use.
 - Monitoring Test Kits (CHEMets Ammonia & Surfactants kits)
 - Field Test Meters (Extech EC500 "ExStik") and buffer solutions
 - Gloves
 - Paper Towels/Rags
 - Distilled Water (for rinsing equipment after sampling)
 - Sampling Cup
 - Extendable Pole (to attach sampling cup if necessary)
 - Bucket and 25 feet of rope to take samples from deeper manholes
 - Sample Bottles or Graduated cylinders
 - Ruler/Tape Measure
 - Permanent marker for bottle labels
 - Camera
 - Maps
 - Safety cones or other city required safety gear for vehicles parked on the side of the road
 - Safety vests and safety glasses for each person
 - Copies of the Stormwater Outfall Inspection Form
 - Clipboard
 - Laboratory Custody Sheets
 - Handheld GPS device (potential)
 - iPad or similar electronic pad (potential)
 - Bug spray, poison ivy repellants/cleansers
2. At the start of each field day, the field meter should be calibrated. The calibration should be checked periodically (at least once) during the day. If the reading is different than the test solution, this should be recorded on a meter calibration record sheet. Custody sheets and laboratory sample bottles for any lab testing need to be available on days when these samples will be collected.
3. Before the first use or after storage, the ExStik (for pH, temperature, and conductivity) needs to be soaked in tap water for 10 minutes. The device should be calibrated with a pH 7 buffer solution first, then calibrated with a buffer solution closest to the expected pH value of the solution or material to be tested.
4. Locate outfalls to be inspected for the day on map (or by GPS coordinates). Prepare a route to efficiently locate as many outfalls as possible. If a crew of 3 people or 2 crews of 2 people are available then have one person or crew ahead locating outfalls and 2 people behind to take samples and perform field tests if necessary.

5. Prior to sampling of any outfall, ensure there has been a complete 24-hour period of no rain.
6. Make sure that the sample collection cups and buckets are all thoroughly rinsed with distilled water to avoid cross-contamination.

Outfall Inspection & Dry-Weather Flow Sampling Procedures

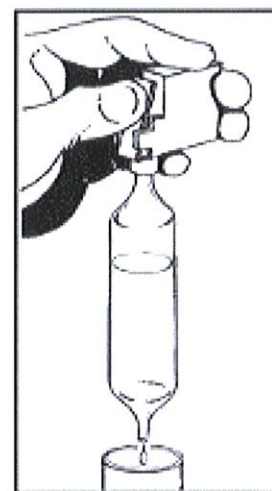
1. Observe the outfall condition and record a description of the outfall pipe material, shape, diameter, any damage, or deposits/stains on the Stormwater Outfall Inspection Form. Record the date, time, weather, and who is performing the inspection.
2. Take a photograph of the outfall. Photographs of the surrounding area should be taken as well to help identify the area and any observations. Identify photographs by number so that they are differentiated.
3. Thoroughly complete Sections 1, 2, and 3 of the Stormwater Outfall Inspection Form.
4. If outfall has dry-weather flow, then observe the flow and complete Section 4 of the Stormwater Outfall Inspection Form.
5. If there has been a 24-hour dry weather period, then a sample should be taken for field testing. Please note that dry-weather flow samples to be sent to the laboratory will be collected on a single morning instead of being collected as each outfall is inspected.
6. Sample Collection and Analysis
 - Begin sample collection by putting on the protective gloves.
 - Collect a sample of the outfall flow using the sampling cup or bucket. Utilize the extendable pole if necessary to collect the sample. Obtain at least 50-100 mL of flowing water, if possible.
 - First, the sample will be evaluated using the EC500 ExStik field meter to take measurements for pH, temperature, and specific conductivity. See graphic below for a display example.
 - Remove the cap from the bottom of the ExStik to expose the electrode.
 - Press the ON button. "SELF CAL" will appear on the display during the turn-on diagnostics.

- Insert the electrode into the sample making sure that the electrode is completely submersed.
- Slowly stir the solution with the electrode to remove air bubbles.
- To obtain parameter measurements, depress and hold the MODE/HOLD key for 2 seconds to scroll to the desired parameter. The display will begin to scroll through the units: **μS** (for conductivity); **pH**; **ppm S** (for salinity); **ppm** (for TDS); **mg/l** (for TDS). Let go of the button to stop the scroll, push again to advance to the next reading.

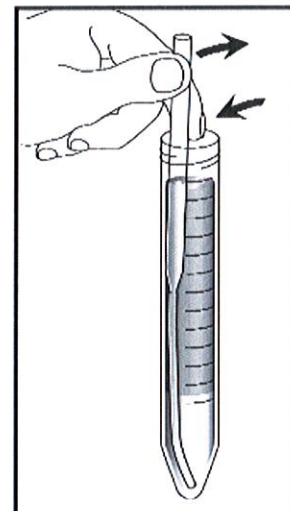


7. Use the CHEMets K9400 test kit to measure surfactants (detergents) in the sample.

- Open the kit and locate the reaction tube, reagent ampoule, reaction mixing tube and cap, and comparator ampoule.
- Rinse the reaction tube with the sample to be tested, and then fill it to the 5 mL mark with the sample.
- While holding the double-tipped ampoule (containing the blue reagent) in a vertical position, snap the upper tip using the tip breaking tool.
- Invert the reagent ampoule and position the open end over the reaction tube. Snap the upper tip to allow the contents to drain into the reaction tube (see diagram on right).
- Cap the reaction tube and shake it vigorously for 30 seconds. Allow the tube to stand undisturbed for 1 minute.



- Make sure that the flexible tubing is firmly attached to the CHEMets comparator ampoule tip.
- Insert the CHEMets comparator ampoule (tubing first) along the side of the reaction tube making sure that the end of the flexible tubing is at the bottom of the tube and below the blue reagent level.
- Break the tip of the CHEMets ampoule by gently pressing it against the side of the reaction tube. The ampoule should draw in fluid only from the organic phase (bottom layer). See diagram to the right.
- When filling is complete, remove the CHEMets comparator ampoule from the reaction tube.
- Remove the flexible tubing from the CHEMets comparator ampoule and wipe all liquid from the exterior of the ampoule. Place an ampoule cap firmly onto the tip of the CHEMets comparator ampoule. Invert the comparator ampoule several times, allowing the bubble to travel from end to end.
- Obtain a test result by placing the comparator ampoule, flat end first, into the comparator. Hold the comparator up toward a source of light and view from the bottom. Rotate the comparator until the best color match is found and record the concentration of surfactants.



8. Use the CHEMets test strips and colorimetric scale to analyze the sample for ammonia concentrations and chlorine residual.
9. Based upon results determined by the ammonia and surfactants test and the visual observations of the dry weather flow, it may be necessary to collect an additional sample to send to the laboratory for bacteria testing (either E. Coli or Enterococcus or Fecal Coliform).

If this is the case, laboratory sample collection and delivery to the laboratory needs to be coordinated so that the sample hold times are met. Generally, bacteria laboratory sample collection should be finished by 12 noon (Monday through Thursday) so that samples can be conveyed to the laboratory in time to start processing within the hold times. This will be coordinated further as the program progresses.

- Transfer dry-weather flow from the outfall sampling cup into the sterile sample bottles supplied by the laboratory. Fill the sample bottle to the fill line on the bottle.
 - Fill out the information on the sample bottle to note date and time of sample, sample location, person taking the sample, and ensure that the right analytical test will be performed on the sample at the laboratory.
 - Complete the Chain of Custody form.
 - Put the sample(s) on ice in a cooler.
 - Coordinate with laboratory to collect the samples or plan to drop them off at the laboratory location in Concord, NH. Fecal Coliform samples go to the WWTP.
10. Make sure that the sample collection cups and buckets are all thoroughly rinsed with distilled water to avoid cross-contamination after each sample round.

Appendix E

Table 3 Priority Outfalls for Further Investigation (IDDE)

*Excerpted from
2014/2015 Dry Weather MS4/Stormwater
Outfall Inspection Program (Revised 2017)*

Appendix F

Sanitary Sewer Overflows Historical Reporting

[illegible]

Appendix G

IDDE Manual Revisions History

Revision	Date	Description of changes	Approved by
Original	2004		Paul Jessel
Revision 1	2/8/2017	Rewrote the entire IDDE Manual	Paul Jessel
Revision 2	3/3/2017	Added Section 7 Corrective Action/ Enforcement	Paul Jessel
Revision 3	6/29/2020	Updated IDDE priority, sampling, SVF, SSOs	Jesse Middleton