Illicit Discharge Detection and Elimination (IDDE) Plan

Town of Milton, MA

2019
Lasted update 11/2020

This program was adapted for the Town of Milton from the Central MA Stormwater Coalition and Fuss & O'Neill's IDDE Plan.

The original project was financed with funds from the Massachusetts Department of Environmental Protection. The contents do not necessarily reflect the views and policies of MassDEP, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

1. Introduction

MS4 Program

This Illicit Discharge Detection and Elimination (IDDE) Plan has been developed by the Town of Milton (Town) to address the requirements of the United States Environmental Protection Agency's (USEPA's) 2016 National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) in Massachusetts, hereafter referred to as the "2016 Massachusetts MS4 Permit" or "MS4 Permit."

The 2016 Massachusetts MS4 Permit requires that each permittee, or regulated community, address six Minimum Control Measures. These measures include the following:

1. Public Education and Outreach
2. Public Involvement and Participation
3. Illicit Discharge Detection and Elimination Program
4. Construction Site Stormwater Runoff Control
5. Stormwater Management in New Development and Redevelopment (Post Construction Stormwater Management); and
6. Good Housekeeping and Pollution Prevention for Permittee Owned Operations.

Under Minimum Control Measure 3, the permittee is required to implement an IDDE program to systematically find and eliminate sources of non-stormwater discharges to its municipal separate storm sewer system and implement procedures to prevent such discharges. The IDDE program must also be recorded in a written (hardcopy or electronic) document. This IDDE Plan has been prepared to address this requirement.

Illicit Discharges

An "illicit discharge" is any discharge to a drainage system that is not composed entirely of stormwater, with the exception of discharges pursuant to a NPDES permit (other than the NPDES permit for discharges from the MS4) and discharges resulting from fire-fighting activities.

Illicit discharges may take a variety of forms. Illicit discharges may enter the drainage system through direct or indirect connections. Direct connections may be relatively obvious, such as cross-connections of sewer services to the storm drain system. Indirect illicit discharges may be more difficult to detect or address, such as failing septic systems that discharge untreated sewage to a ditch within the MS4, or a sump pump that discharges contaminated water on an intermittent basis.

Some illicit discharges are intentional, such as dumping used oil (or other pollutant) into catch basins, a resident or contractor illegally tapping a new sewer lateral into a storm drain pipe to avoid the costs of a sewer connection fee and service, and illegal dumping of yard wastes into surface waters.

Some illicit discharges are related to the unsuitability of original infrastructure to the modern regulatory environment. Examples of illicit discharges in this category include connected floor

drains in old buildings, as well as sanitary sewer overflows that enter the drainage system. Sump pumps legally connected to the storm drain system may be used inappropriately, such as for the disposal of floor washwater or old household products, in many cases due to a lack of understanding on the part of the homeowner.

Elimination of some discharges may require substantial costs and efforts, such as funding and designing a project to reconnect sanitary sewer laterals. Others, such as improving self-policing of dog waste management, can be accomplished by outreach in conjunction with the minimal additional cost of dog waste bins and the municipal commitment to disposal of collected materials on a regular basis.

Regardless of the intention, when not addressed, illicit discharges can contribute high levels of pollutants, such as heavy metals, toxics, oil, grease, solvents, nutrients, and pathogens to surface waters.

In general, illicit discharges are classified into three categories:

1. Transitory illicit discharges are typically one-time events resulting from spills, breaks, dumping, or accidents. Transitory illicit discharges are often reported to an authority through a citizen complaint line or following observation by a municipal employee during regular duties. Because they are not recurring, they are the most difficult to identify, trace, and remove. The best method to reduce transitory discharges is through general public education, education of municipal response personnel, tracking of discharge locations, and enforcement of an illicit discharge ordinance.

2. Intermittent illicit discharges occur occasionally over a period of time (several hours per day, or a few days per year). Intermittent discharges can result from legal connections to the storm drain system, such as a legal sump pump connection that is illegally discharging anything other than groundwater. Intermittent discharges can also result from activities such as drum washing in exterior areas. These types of discharges are more likely to be discovered, and are less difficult to trace and remove, but can still present significant challenges. These discharges can have large or small impacts on waterbodies depending on pollutant content and the size of the receiving water body.

3. Continuous illicit discharges are typically the result of a direct connection from a sanitary sewer, overflow from a malfunctioning septic system, inflow from a nearby subsurface sanitary sewer that is malfunctioning, or an illegal connection from a commercial or industrial facility. Continuous illicit discharges are usually easiest to trace and can have the greatest pollutant load.

Allowable Non-Stormwater Discharges

The following categories of non-storm water discharges are allowed under the MS4 Permit unless the permittee, USEPA or Massachusetts Department of Environmental Protection (MassDEP) identifies any category or individual discharge of non-stormwater discharge as a significant contributor of pollutants to the MS4:

- Water line flushing
- Landscape irrigation
- Diverted stream flows
- Rising ground water

- Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20))
- Uncontaminated pumped groundwater
- Discharge from potable water sources
- Foundation drains
- Air conditioning condensation
- Irrigation water, springs
- Water from crawl space pumps
- Footing drains
- Lawn watering
- Individual resident car washing
- De-chlorinated swimming pool discharges
- Street wash waters
- Residential building wash waters without detergents

If these discharges are identified as significant contributors to the MS4, they must be considered an "illicit discharge" and addressed in the IDDE Plan (i.e., control these sources so they are no longer significant contributors of pollutants, and/or eliminate them entirely).

Receiving Waters and Impairments

Table 1-1 lists the "impaired waters" within the boundaries of the Town of Milton's regulated area based on the 2014 Massachusetts Integrated List of Waters. This list is produced by MassDEP every two years. Impaired waters are water bodies that do not meet water quality standards for one or more designated use(s) such as recreation or aquatic habitat. At the end of the list, water bodies located in Milton that do not receive flow from the MS4 are included.

Table 1. Impaired Waters

Waterbody segment that receives flow from the MS4	Number of outfalls into receiving water segment (approximate)	Chloride	Chlorophyll-a	Dissolved oxygen/ DO saturation	Nitrogen	Oil and Grease/PAH	Phosphorus	Solids/TSS/Turbidit	E. coli	Enterococcus	Other pollutants causing impairments
Pine Tree Brook	97	☐	☐	☒	☐	☐	☐	☒	☒	☐	Physical substrate habitat alterations Aquatic plants Fecal coliform
Neponset River (MA 73-02)	18	☐	☐	☒	☐	☒	☐	☒	☒	☐	Debris/Floatables/Trash DDT Fecal coliform Foam/Flocs/Scum/Oil slicks PCB in fish tissue
Neponset River (MA 73-03)	25	☐	☐	☒	☐	☒	☐	☐	☒	☒	Debris/Floatables/Trash DDT Fecal coliform Foam/Flocs/Scum/Oil slicks PCB in fish tissue PCB
Unquity Brook	42	☐	☐	☒	☐	☐	☒	☒	☒	☐	Debris/Floatables/Trash Low flow alterations Physical substrate habitat alterations Fecal coliform Low pH
Neponset River (MA 73-04)	15	☐	☐	☒	☐	☐	☐	☒	☒	☒	Debris/Floatables/Trash Fecal coliform PCB
Russell Pond	6	☐	☐	☐	☐	☐	☐	☒	☐	☐	Non-native aquatic plants
Turners Pond	1	☐	☐	☒	☐	☐	☐	☒	☐	☐	Nutrient/eutrophication biological indicators
Popes Pond	1	☐	☐	☒	☐	☐	☐	☒	☒	☐	Physical substrate habitat alterations Aquatic plants Fecal coliform
Gulliver Creek	2	☐	☐	☐	☐	☐	☐	☐	☐	☐	Fecal coliform PCB in fish tissue
Balster Brook	5	☐	☐	☐	☐	☐	☐	☐	☐	☐	n/a
Hemenway Pond	1	☐	☐	☐	☐	☐	☐	☐	☐	☐	n/a
Trout Brook	7	☐	☐	☐	☐	☐	☐	☐	☐	☐	n/a
Wendell Brook	1	☐	☐	☐	☐	☐	☐	☐	☐	☐	n/a

Chestnut Run	1	☐	☐	☐	☐	☐	☐	☐	☐	☐	n/a
Blue Hill River	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	n/a
Houghton's Pond/Hoosicwhisick Pond	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	n/a
Hillside Pond	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	n/a
Coon Hollow Brook	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	n/a
Unnamed Tributary (Hemenway Pond – Neponset River)	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	n/a

IDDE Program Goals, Framework, and Timeline

The goals of the IDDE program are to find and eliminate illicit discharges to municipal separate storm sewer system and to prevent illicit discharges from happening in the future. The program consists of the following major components as outlined in the MS4 Permit:

- Legal authority and regulatory mechanism to prohibit illicit discharges and enforce this prohibition
- Storm system mapping
- Inventory and ranking of outfalls
- Dry weather outfall screening
- Catchment investigations
- Identification/confirmation of illicit sources
- Illicit discharge removal
- Followup screening
- Employee training.

Per the 2016 MS4 Permit, the Town may choose to use the services of another entity for work related to satisfying the requirements of the permit. If the Town chooses to do so for illicit discharge detection and elimination services, information about the Town's agreements with any entity will be included in the IDDE program.

The IDDE investigation procedure framework is shown in **Figure 1-1.** The required timeline for implementing the IDDE program is shown in **Table 1-2**.

Figure 1-1. IDDE Investigation Procedure Framework

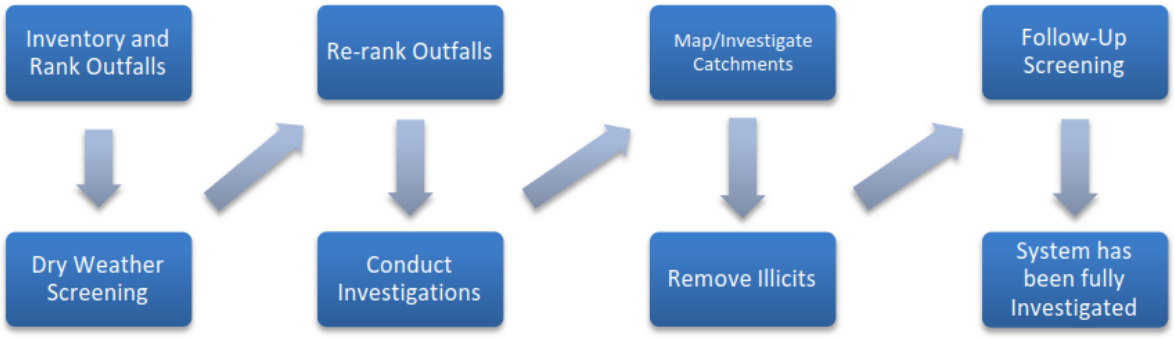


Table 2. IDDE Program Implementation Timeline

IDDE Program Requirement	Completion Date from Effective Date of Permit					
	1 Year	1.5 Years	2 Years	3 Years	7 Years	10 Years
Written IDDE Program Plan	X					
SSO Inventory	X					
Written Catchment Investigation Procedure		X				
Phase I Mapping			X			
Phase II Mapping						X
IDDE Regulatory Mechanism or By-law (if not already in place)				X		
Dry Weather Outfall Screening				X		
Follow-up Ranking of Outfalls and Interconnections				X		
Catchment Investigations – Problem Outfalls					X	
Catchment Investigations – all Problem, High and Low Priority Outfalls						X

Work Completed to Date

The 2003 MS4 Permit required each MS4 community to develop a plan to detect illicit discharges using a combination of storm system mapping, adopting a regulatory mechanism to prohibit illicit discharges and enforce this prohibition, and identifying tools and methods to investigate suspected illicit discharges. Each MS4 community was also required to define how confirmed discharges would be eliminated and how the removal would be documented.

The town of Milton has completed the following IDDE program activities consistent with the 2003 MS4 Permit requirements:

- Developed a map of outfalls and receiving waters
- Adopted an IDDE bylaw or regulatory mechanism (Sewer Regulation)
- Developed procedures for locating illicit discharges (visual screening; optical brightener test; CCTV inspections)
- Developed procedures for locating the source of the discharge
- Developed procedures for removal of the source of an illicit discharge
- Developed procedures for documenting actions and evaluating impacts on the storm sewer system subsequent to removal

In addition to the 2003 MS4 Permit requirements, other IDDE-related activities that were completed include:

- Additional storm system mapping, including the locations of catch basins, manholes and pipe connectivity
- Investigation of possible illicit discharges with the Neponset River Watershed Association
- Removal of sewer underdrains found during sewer rehabilitation

2. Authority and Statement of IDDE Responsibilities

Legal Authority

The Town of Milton has adopted a Sewer Regulation (Revised 2003). A copy of the Sewer Regulation is provided in **Appendix A**. The Sewer Regulation provides the Town with adequate legal authority to:

- Prohibit illicit discharges
- Investigate suspected illicit discharges
- Eliminate illicit discharges, including discharges from properties not owned by or controlled by the MS4 that discharge into the MS4 system
- Implement appropriate enforcement procedures and actions.

Statement of Responsibilities

The Department of Public works is the lead municipal agency or department responsible for implementing the IDDE program pursuant to the provisions of the Stormwater Bylaw and the 2016 MS4 Permit. Other agencies or departments with responsibility for aspects of the program include:

- Department of Public Works –
    - Has primary responsibility for coordinating compliance with the Phase II NPDES MS4 Stormwater Permit.
    - Has primary authority to prohibit, investigate, and eliminate illicit discharges to the public sewers.
    - Has primary responsibility for documenting suspected illicit discharges and providing for appropriate investigation, including but not limited to water quality monitoring, closed-circuit television inspection, smoke testing, and dye testing.
    - Coordinates as necessary with GIS Analyst to maintain a current and accurate map of the storm drain system.
    - Ensures that staff receives training in illicit discharge detection and elimination.
    - Explains, justifies and defends Department programs, policies, and activities; negotiates and resolves sensitive and controversial issues.
    - Coordinates Water and Sewer departments for new utility connections.
    - Provides for effective management and financing of the municipality's stormwater system.
- Building Inspector and/or Code Enforcement Officer –
    - Reviews and inspects all building construction projects in accordance with local, state and federal codes.
    - Reviews proposed construction plans or submissions and coordinates utility connections and coordinates with Department of Public Works for enforcement of Correct Connection Regulation.
    - Performs on-site inspections and field investigations to verify that building codes are met.
    - Responds to concerns regarding possible infractions of building codes and permit procedures.
    - Issues stop work orders to perpetrators who are conducting unauthorized work.
- Licensed Plumbing Inspector –

    - Reviews and inspects all building construction projects in accordance with local, state and federal codes.
    - Investigates complaints of possible code violations, including building, sanitation, and zoning violations and initiate appropriate remedial action to ensure compliance.
- Health Department –
    - Enforces compliance with MA Title 5 Regulations.
    - Provides information and inspection services for septic systems.
    - Investigates and reports on all health hazards, complaints, and nuisances.
    - Issues cease and desist orders for violations of sanitation code.

3. Stormwater System Mapping

The Town originally developed mapping of its stormwater system to meet the mapping requirements of the 2003 MS4 Permit. A copy of the existing storm system map is provided in **Appendix B**. The 2016 MS4 Permit requires a more detailed storm system map than was required by the 2003 MS4 Permit. The revised mapping is intended to facilitate the identification of key infrastructure, factors influencing proper system operation, and the potential for illicit discharges.

The 2016 MS4 Permit requires the storm system map to be updated in two phases as outlined below. The Engineering Department is responsible for updating the stormwater system mapping pursuant to the 2016 MS4 Permit. The Town will report on the progress towards completion of the storm system map in each annual report. Updates to the stormwater mapping will be included in **Appendix B**.

Phase I Mapping

Phase I mapping must be completed within two (2) years of the effective date of the permit (July 1, 2020) and include the following information:

- Outfalls and receiving waters (previously required by the MS4-2003 permit)
- Open channel conveyances (swales, ditches, etc.)
- Interconnections with other MS4s and other storm sewer systems
- Municipally owned stormwater treatment structures
- Water bodies identified by name and indication of all use impairments as identified on the most recent EPA approved Massachusetts Integrated List of Waters report
- Initial catchment delineations. Topographic contours and drainage system information may be used to produce initial catchment delineations.

The Town will update its stormwater mapping by July 1, 2020 to include Phase I information.

Phase II Mapping

Phase II mapping must be completed within ten (10) years of the effective date of the permit (July 1, 2027) and include the following information:

- Outfall spatial location (latitude and longitude with a minimum accuracy of +/-30 feet)
- Pipes
- Manholes
- Catch basins
- Refined catchment delineations. Catchment delineations must be updated to reflect information collected during catchment investigations.
- Municipal Sanitary Sewer system (if available)
- Municipal combined sewer system (if applicable).

The Town will update its stormwater mapping by July 1, 2028 to include Phase II information.

Additional Recommended Mapping Elements

Although not a requirement of the 2016 MS4 Permit, the Town will include the following recommended elements in its storm system mapping when possible:

- Storm sewer material, size (pipe diameter), age
- Sanitary sewer system material, size (pipe diameter), age
- Privately owned stormwater treatment structures
- Where a municipal sanitary sewer system exists, properties known or suspected to be served by a septic system, especially in high density urban areas
- Area where the permittee's MS4 has received or could receive flow from septic system discharges
- Seasonal high water table elevations impacting sanitary alignments
- Topography
- Orthophotography
- Alignments, dates and representation of work completed of past illicit discharge investigations
- Locations of suspected confirmed and corrected illicit discharges with dates and flow estimates.

4. Sanitary Sewer Overflows (SSOs)

The 2016 MS4 Permit requires municipalities to prohibit illicit discharges, including sanitary sewer overflows (SSOs), to the separate storm sewer system. SSOs are discharges of untreated sanitary wastewater from a municipal sanitary sewer that can contaminate surface waters, cause serious water quality problems and property damage, and threaten public health. SSOs can be caused by blockages, line breaks, sewer defects that allow stormwater and groundwater to overload the system, power failures, improper sewer design, and vandalism.

The Town has completed an inventory of SSOs that have discharged to the MS4 within the five (5) years prior to the effective date of the 2016 MS4 Permit, based on review of available documentation pertaining to SSOs (**Table 4-1**). The inventory includes all SSOs that occurred during wet or dry weather resulting from inadequate conveyance capacities or where interconnectivity of the storm and sanitary sewer infrastructure allows for transfer of flow between systems.

Upon detection of an SSO, the Town will eliminate it as expeditiously as possible and take interim measures to minimize the discharge of pollutants to and from its MS4 until the SSO is eliminated. Upon becoming aware of an SSO to the MS4, the Town will provide oral notice to EPA within 24 hours and written notice to EPA and MassDEP within five (5) days of becoming aware of the SSO occurrence.

The inventory in **Table 4-1** will be updated by the Department of Public Works when new SSOs are detected. The SSO inventory will be included in the annual report, including the status of mitigation and corrective measures to address each identified SSO.

Table 3. SSO Inventory

Milton, Massachusetts
Revision Date: July 2019

SSO Location[1]	Discharge Statement[2]	Date[3]	Time Start[3]	Time End[3]	Estimated Volume[4]	Description[5]	Mitigation Completed[6]	Mitigation Planned[7]
840 Brook Rd. Milton MA 02186	Ground surface (no release to surface water)	12/20/2017 – 12/21/17	10:00am 12/20	11:00 am 12/21	4800 gal	Sewer system blockage	Jet rodding and vactor to clear blockage	Determine ownership; CCTV investigation
South of 777 Randolph Avenue (Rt. 28)	Discharge from pump station to ground surface (no release to surface water)	9/27/18	10:00am	5:30 pm	1650 gal	Leak in cast iron sewer force main due to crack	Pump station turned off at approximately 5:30pm. Vacuum trucks used to pump out pump station. Force main repaired by 8:30pm. Area cleaned and disinfected with lime.	Existing force main (source of the leak) replaced and online 10/8/18. This replacement had already been scheduled by DPW due to the age of the force main.
Intersection of Forbes Road and Cheryl Drive	From valve chamber to ground surface (no release to surface water)	7/29/2019	7:30am	10:30am	50 gal	Damage to pipe by contractor repairing manhole cover. Contractor accidentally dropped asphalt into chamber.	Vacuum truck used to dewater chamber and repair contractor repaired PVC piping. Spill boom and absorbent pads installed to contain SSO on pavement. Impacted area cleaned and disinfected.	No additional mitigation planned. Pipe repaired.

Opposite 901 Randolph Avenue	Direct small stream tributary to Pine Tree Brook.	11/06/2020	8:00am	5:30pm	8550 gal	Pump station failure, Coupling on foreman broken inside wet well.	Maintained with vacuum truck and installed temporary mobile pump.	Broken force main fitting repaired, and pump returned to normal service.

[1] Location (approximate street crossing/address and receiving water, if any)
[2] A clear statement of whether the discharge entered a surface water directly or entered the MS4
[3] Date(s) and time(s) of each known SSO occurrence (i.e., beginning and end of any known discharge)
[4] Estimated volume(s) of the occurrence
[5] Description of the occurrence indicating known or suspected cause(s)
[6] Mitigation and corrective measures completed with dates implemented
[7] Mitigation and corrective measures planned with implementation schedules

5. Assessment and Priority Ranking of Outfalls

The 2016 MS4 Permit requires an assessment and priority ranking of outfalls in terms of their potential to have illicit discharges and SSOs and the related public health significance. The ranking helps determine the priority order for performing IDDE investigations and meeting permit milestones.

Outfall Catchment Delineations

A catchment is the area that drains to an individual outfall[1] or interconnection.[2] The catchments for each of the MS4 outfalls will be delineated to define contributing areas for investigation of potential sources of illicit discharges. Catchments are typically delineated based on topographic contours and mapped drainage infrastructure, where available. As described in **Section 3**, initial catchment delineations will be completed as part of the Phase I mapping, and refined catchment delineations will be completed as part of the Phase II mapping to reflect information collected during catchment investigations

Outfall and Interconnection Inventory and Initial Ranking

The Department of Public Works or its agent will complete an initial outfall and interconnection inventory and priority ranking to assess illicit discharge potential based on existing information. The initial inventory and ranking will be completed within one (1) year from the effective date of the permit. An updated inventory and ranking will be provided in each annual report thereafter. The inventory will be updated annually to include data collected in connection with dry weather screening and other relevant inspections.

The outfall and interconnection inventory will identify each outfall and interconnection discharging from the MS4, record its location and condition, and provide a framework for tracking inspections, screenings and other IDDE program activities.

Outfalls and interconnections will be classified into one of the following categories:

1. **Problem Outfalls**: Outfalls/interconnections with known or suspected contributions of illicit discharges based on existing information shall be designated as Problem Outfalls. This shall include any outfalls/interconnections where previous screening indicates likely sewer input. Likely sewer input indicators are any of the following:

    - Olfactory or visual evidence of sewage,
    - Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and bacteria levels greater than the water quality criteria applicable to the receiving water, or

[1] **Outfall** means a point source as defined by 40 CFR § 122.2 as the point where the municipal separate storm sewer discharges to waters of the United States. An outfall does not include open conveyances connecting two municipal separate storm sewers or pipes, tunnels or other conveyances that connect segments of the same stream or other waters of the United States and that are used to convey waters of the United States. Culverts longer than a simple road crossing shall be included in the inventory unless the permittee can confirm that they are free of any connections and simply convey waters of the United States.

[2] **Interconnection** means the point (excluding sheet flow over impervious surfaces) where the permittee's MS4 discharges to another MS4 or other storm sewer system, through which the discharge is conveyed to waters of the United States or to another storm sewer system and eventually to a water of the United States.

- Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and detectable levels of chlorine.

Dry weather screening and sampling, as described in **Section 6** of this IDDE Plan and Part 2.3.4.7.b of the MS4 Permit, is not required for Problem Outfalls.

2. **High Priority Outfalls**: Outfalls/interconnections that have not been classified as Problem Outfalls and that are:

    - Discharging to an area of concern to public health due to proximity of public beaches, recreational areas, drinking water supplies or shellfish beds
    - Determined by the permittee as high priority based on the characteristics listed below or other available information.

3. **Low Priority Outfalls**: Outfalls/interconnections determined by the permittee as low priority based on the characteristics listed below or other available information.

4. **Excluded outfalls**: Outfalls/interconnections with no potential for illicit discharges may be excluded from the IDDE program. This category is limited to roadway drainage in undeveloped areas with no dwellings and no sanitary sewers; drainage for athletic fields, parks or undeveloped green space and associated parking without services; cross-country drainage alignments (that neither cross nor are in proximity to sanitary sewer alignments) through undeveloped land.

Outfalls will be ranked into the above priority categories (except for excluded outfalls, which may be excluded from the IDDE program) based on the following characteristics of the defined initial catchment areas, where information is available. Additional relevant characteristics, including location-specific characteristics, may be considered but must be documented in this IDDE Plan.

- **Previous screening results** – previous screening/sampling results indicate likely sewer input (see criteria above for Problem Outfalls).
- **Past discharge complaints and reports**
- **Poor receiving water quality** – the following guidelines are recommended to identify waters as having a high illicit discharge potential:
    - Exceeding water quality standards for bacteria
    - Ammonia levels above 0.5 mg/l
    - Surfactants levels greater than or equal to 0.25 mg/l
- **Density of generating sites** – Generating sites are those places, including institutional, municipal, commercial, or industrial sites, with a potential to generate pollutants that could contribute to illicit discharges. Examples of these sites include, but are not limited to, car dealers; car washes; gas stations; garden centers; and industrial manufacturing areas.
- **Age of development and infrastructure** – Industrial areas greater than 40 years old and areas where the sanitary sewer system is more than 40 years old will probably have a high illicit discharge potential. Developments 20 years or younger will probably have a low illicit discharge potential.
- **Surrounding density of aging septic systems** – Septic systems thirty years or older in residential land use areas are prone to have failures and may have a high illicit discharge potential.

- **Culverted streams** – Any river or stream that is culverted for distances greater than a simple roadway crossing may have a high illicit discharge potential.
- **Water quality limited waterbodies** that receive a discharge from the MS4 or waters with approved TMDLs applicable to the permittee, where illicit discharges have the potential to contain the pollutant identified as the cause of the water quality impairment.

The outfall inventory exists in the Town's GIS database. Each outfall in the database has a Priority attribute, which indicates whether the outfall is a Problem outfall, High priority, Low priority, or excluded. Each outfall's ID, rank, and location is shown in Table 5-1.

Table 5-1. Outfalls, locations, and priority rank, presented in order of priority.

Outfall ID	Latitude	Longitude	Priority
OF0158	42.24	-71.09	Problem
New	42.25	-71.08	Problem
OF0023	42.26	-71.08	Problem
OF0042	42.26	-71.08	Problem
OF0043	42.26	-71.08	Problem
OF0010	42.25	-71.09	High Priority
OF0107	42.23	-71.08	High Priority
OF0011	42.26	-71.06	High Priority
OF0113	42.24	-71.10	High Priority
OF0120	42.24	-71.09	High Priority
OF0122	42.24	-71.11	High Priority
OF0126	42.22	-71.08	High Priority
OF0140	42.25	-71.10	High Priority
OF0162	42.24	-71.09	High Priority
OF0163	42.26	-71.10	High Priority
OF0174	42.23	-71.12	High Priority
OF0018	42.26	-71.10	High Priority
OF0019	42.26	-71.10	High Priority
OF0002	42.25	-71.09	High Priority
OF0020	42.26	-71.10	High Priority
OF0021	42.26	-71.10	High Priority
OF0022	42.26	-71.08	High Priority
OF0026	42.26	-71.05	High Priority
OF0027	42.26	-71.05	High Priority
OF0029	42.26	-71.04	High Priority
OF0003	42.25	-71.09	High Priority
OF0034	42.26	-71.09	High Priority
OF0004	42.25	-71.09	High Priority
OF0049	42.26	-71.05	High Priority
OF0005	42.26	-71.09	High Priority
OF0050	42.26	-71.05	High Priority

Outfall ID	Latitude	Longitude	Priority
OF0059	42.27	-71.08	High Priority
OF0060	42.27	-71.08	High Priority
OF0061	42.27	-71.08	High Priority
OF0062	42.27	-71.08	High Priority
OF0078	42.27	-71.04	High Priority
OF0079	42.27	-71.04	High Priority
OF0080	42.27	-71.04	High Priority
OF0082	42.27	-71.05	High Priority
OF0009	42.25	-71.09	High Priority
OF0090	42.25	-71.07	High Priority
OF0096	42.25	-71.10	High Priority
OF0014	42.26	-71.05	High Priority
OF0016	42.26	-71.05	High Priority
OF0171	42.23	-71.12	High Priority
OF0173	42.23	-71.12	High Priority
OF0030	42.26	-71.05	High Priority
OF0035	42.26	-71.09	High Priority
OF0044	42.26	-71.08	High Priority
OF0046	42.26	-71.08	High Priority
OF0057	42.25	-71.06	High Priority
OF0072	42.27	-71.07	High Priority
OF0073	42.27	-71.09	High Priority
OF0086	42.25	-71.08	High Priority
OF0087	42.25	-71.08	High Priority
OF0091	42.25	-71.07	High Priority
OF0094	42.25	-71.06	High Priority
OF0101	42.23	-71.12	Low Priority
OF0102	42.23	-71.12	Low Priority
OF0104	42.24	-71.07	Low Priority
OF0105	42.24	-71.07	Low Priority
OF0106	42.23	-71.11	Low Priority

Outfall ID	Latitude	Longitude	Priority
OF0108	42.23	-71.08	Low Priority
OF0109	42.23	-71.11	Low Priority
OF0110	42.23	-71.07	Low Priority
OF0111	42.23	-71.07	Low Priority
OF0112	42.22	-71.12	Low Priority
OF0114	42.24	-71.10	Low Priority
OF0116	42.24	-71.10	Low Priority
OF0012	42.26	-71.08	Low Priority
OF0123	42.24	-71.10	Low Priority
OF0124	42.24	-71.10	Low Priority
OF0125	42.24	-71.10	Low Priority
OF0127	42.24	-71.11	Low Priority
OF0128	42.25	-71.11	Low Priority
OF0129	42.25	-71.11	Low Priority
OF0130	42.25	-71.11	Low Priority
OF0013	42.26	-71.05	Low Priority
OF0131	42.25	-71.11	Low Priority
OF0133	42.23	-71.12	Low Priority
OF0134	42.23	-71.12	Low Priority
OF0135	42.22	-71.12	Low Priority
OF0136	42.23	-71.12	Low Priority
OF0137	42.23	-71.12	Low Priority
OF0138	42.23	-71.12	Low Priority
OF0139	42.22	-71.12	Low Priority
OF0141	42.25	-71.10	Low Priority
OF0142	42.22	-71.07	Low Priority
OF0143	42.24	-71.10	Low Priority
OF0144	42.24	-71.10	Low Priority
OF0145	42.24	-71.10	Low Priority
OF0147	42.24	-71.09	Low Priority
OF0148	42.24	-71.09	Low Priority
OF0149	42.24	-71.09	Low Priority
OF0150	42.25	-71.09	Low Priority
OF0151	42.26	-71.07	Low Priority
OF0154	42.24	-71.10	Low Priority
OF0155	42.24	-71.10	Low Priority
OF0156	42.23	-71.07	Low Priority
OF0157	42.23	-71.07	Low Priority
OF0159	42.25	-71.09	Low Priority
OF0160	42.25	-71.09	Low Priority

Outfall ID	Latitude	Longitude	Priority
OF0165	42.26	-71.10	Low Priority
OF0166	42.26	-71.10	Low Priority
OF0167	42.23	-71.12	Low Priority
OF0175	42.27	-71.07	Low Priority
OF0176	42.27	-71.07	Low Priority
OF0025	42.26	-71.08	Low Priority
OF0031	42.26	-71.05	Low Priority
OF0040	42.26	-71.08	Low Priority
OF0041	42.26	-71.08	Low Priority
OF0048	42.26	-71.07	Low Priority
OF0051	42.26	-71.06	Low Priority
OF0052	42.25	-71.05	Low Priority
OF0053	42.25	-71.05	Low Priority
OF0054	42.25	-71.10	Low Priority
OF0055	42.25	-71.10	Low Priority
OF0056	42.25	-71.07	Low Priority
OF0006	42.26	-71.09	Low Priority
OF0063	42.27	-71.07	Low Priority
OF0066	42.27	-71.07	Low Priority
OF0067	42.27	-71.07	Low Priority
OF0007	42.26	-71.09	Low Priority
OF0071	42.27	-71.07	Low Priority
OF0074	42.27	-71.09	Low Priority
OF0075	42.27	-71.09	Low Priority
OF0076	42.27	-71.06	Low Priority
OF0077	42.27	-71.05	Low Priority
OF0008	42.25	-71.09	Low Priority
OF0081	42.27	-71.04	Low Priority
OF0083	42.27	-71.04	Low Priority
OF0084	42.25	-71.08	Low Priority
OF0085	42.25	-71.08	Low Priority
OF0088	42.25	-71.08	Low Priority
OF0089	42.25	-71.08	Low Priority
OF0093	42.25	-71.07	Low Priority
OF0097	42.25	-71.10	Low Priority
OF0098	42.23	-71.07	Low Priority
OF0103	42.24	-71.12	Low Priority
OF0115	42.24	-71.10	Low Priority
OF0117	42.24	-71.10	Low Priority
OF0168	42.23	-71.12	Low Priority

Outfall ID	Latitude	Longitude	Priority
OF0017	42.26	-71.05	Low Priority
OF0028	42.26	-71.05	Low Priority
OF0032	42.26	-71.05	Low Priority
OF0033	42.26	-71.05	Low Priority
OF0038	42.26	-71.09	Low Priority
OF0039	42.26	-71.09	Low Priority

Outfall ID	Latitude	Longitude	Priority
OF0058	42.25	-71.06	Low Priority
OF0064	42.27	-71.07	Low Priority
OF0070	42.27	-71.07	Low Priority
OF0092	42.25	-71.07	Low Priority

6. Dry Weather Outfall Screening and Sampling

Dry weather flow is a common indicator of potential illicit connections. The MS4 Permit requires all outfalls/interconnections (excluding Problem and excluded Outfalls) to be inspected for the presence of dry weather flow. The Department of Public Works is responsible for conducting dry weather outfall screening or contracting for screening services. Screening shall start with High Priority outfalls, followed by Low Priority outfalls, based on the initial priority rankings described in the previous section.

Weather Conditions

Dry weather outfall screening and sampling may occur when no more than 0.1 inches of rainfall has occurred in the previous 24-hour period and no significant snow melt is occurring. For purposes of determining dry weather conditions, program staff will use precipitation data from Blue Hill Weather Station. If Blue Hill is not available or not reporting current weather data, then Taunton National Weather Service or Boston Logan International Airport will be used as a back-up.

Dry Weather Screening/Sampling Procedure

The Town will ensure that its screening practices are compliant with the 2016 Small MS4 Permit. If the Town elects to contract for screening services, these written procedures will be replaced with the contractor's Town-approved written procedure.

Dry Weather Screening Procedure

The Town has created a Standard Operating Procedure for dry weather outfall inspection. This SOP is included in Appendix C. The general procedure outlines a procedure for visual condition assessment and analytical sample gathering.

General Procedure:

The dry weather outfall inspection and sampling procedure will be consistent with EPA's *Draft Bacterial Source Tracking Protocol (2012)* and will consist of the following general steps:

1. Identify outfall(s) to be screened/sampled based on initial outfall inventory and priority ranking
2. Acquire the necessary staff, mapping, and field equipment (see **Table 6-1** for list of potential field equipment).
3. Conduct the outfall inspection during dry weather.
    a. Mark and photograph the outfall
    b. Record the inspection information and outfall characteristics (digital form using a tablet or similar device) (see form in **Appendix C**)
    c. Look for and record visual/olfactory evidence of pollutants in flowing outfalls including odor, color, turbidity, and floatable matter (suds, bubbles, excrement, toilet paper or sanitary products). Also observe outfalls for deposits and stains, vegetation, and damage to outfall structures.
4. If flow is observed, sample and test the flow following the procedures described in the following sections.
5. If no flow is observed, but evidence of illicit flow exists (illicit discharges are often intermittent or transitory), revisit the outfall during dry weather within one week of the initial observation, if practicable, to perform a second dry weather screening and sample any observed flow. Other

techniques can be used to detect intermittent or transitory flows including conducting inspections during evenings or weekends and using optical brighteners.

6. Input results from screening and sampling into spreadsheet/database. Include pertinent information in the outfall/interconnection inventory and priority ranking.
7. Include all screening data in the annual report.

Field Equipment

Table 6-1 lists field equipment commonly used for dry weather outfall screening and sampling.

Table 6-1. Field Equipment – Dry Weather Outfall Screening and Sampling

Equipment	Use/Notes
Clipboard	For organization of field sheets and writing surface.
Field log books	For documentation/note taking.
Field Sheets (if not using tablet/phone)	Field sheets for both dry weather inspection and dry weather sampling should be available with extras.
Laboratory Specific Chain of Custody Forms	To ensure proper handling of all samples.
Pens/Pencils/Permanent Markers	For proper labeling and notes.
Nitrile Gloves	To protect the sampler as well as the sample from contamination.
Flashlight/headlamp w/batteries	For looking in outfalls or manholes, helpful in early mornings as well.
Cooler with Ice and/or Cold Packs	For transporting samples to the laboratory.
Mobile data collector (phone or tablet)	For collecting dry weather screening and sampling results.
Digital Camera (or phone)	For documenting field conditions at time of inspection.
Personal Protective Equipment (PPE)	Reflective vest, safety glasses and boots at a minimum.
Bug Spray	For protection.
Poison ivy wash (e.g. Tecnu, Zanfel)	For protection.
GPS Receiver (phone/tablet or handheld GPS)	For taking spatial location data.
Handheld Water Quality Meter	For sampling specific conductivity, salinity, temperature and pH.
Ammonia test kits (or strips)	For field testing for ammonia. Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day.
Chlorine test kits	For field testing for chlorine. Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day.
Photometer	For chlorine test kit, as needed.
Surfactants (MBAS) test kits	For field testing for surfactants. Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day.

Equipment	Use/Notes
Disposal Receptacles	Appropriate containers for disposing of used test kits as well as garbage.
Label Tape (or labels provided by laboratory)	For labeling sample containers.
Sample Containers	Make sure all sample containers are clean. Keep extra sample containers on hand at all times. Make sure there are proper sample containers for what is being sampled for (i.e., bacteria require sterile 120mL containers).
Manhole hook	For opening manholes.
Pry Bar or Pick	For opening catch basins and manholes, when necessary.
Shovel	For opening, propping, prying manholes and catch basins, as necessary.
Sandbags	For damming low flows in order to take samples.
Small Mallet or Hammer	To helping free stuck manhole and catch basin covers.
Utility Knife	Multiple uses.
Measuring Tape	Measuring distances and depth of flow.
Safety Cones	For safety.
Hand Sanitizer	For disinfectant/decontamination.
Zip Ties/Duct Tape	For making field repairs.
Rubber Boots/Waders	For accessing shallow streams/areas.
Paper towels	For cleaning.
Distilled water	For rinsing equipment.
Sampling Pole/Dipper/Sampling Cage	For accessing hard to reach outfalls and manholes.

Sample Collection and Analysis

The following sampling procedure will be used to acquire samples for in-situ and laboratory testing (for detailed SOPs see Appendix C):

1. At least one day prior to sampling, coordinate with appropriate laboratories to schedule the laboratory analysis. This coordination will include estimated time of sample delivery and estimated number of samples expected.
2. Visit the designated locations for outfall screening in a two-person crew.
3. Prior to the start of sampling, create a trip blank by filling a laboratory provided container with clean bottled water. The trip blank will have its own unique label and will be kept in a cooler with all other samples collected during that sampling event.
4. Upon arrival at an approved sampling location, record all pertinent observations in electronic format. Pertinent observations include, but are not limited to: flow velocity, approximate depth of water, water color, odor, observed floatables, and sediment or debris deposits. Fill out a comments field with any observations which cannot adequately be described using predefined categories on the field form.

5. If using laboratory provided bottle labels, fill out all sampling information on bottle labels and field sheets (if not using mobile data collection device). If writing directly on laboratory provided sample bottles, skip to Step 6.
6. Put on protective gloves (nitrile/latex/other) before sampling.
7. Collect sample with dipper or directly in sample containers. If possible, collect water from the center of flow directly in the sample bottle. Be careful not to disturb sediments.
8. For samples requiring laboratory analyses, open a sterile container provided by the laboratory. Use caution to ensure that only the outside of the container and its cap are handled to prevent contamination. Fill the sterile container with the sampled water and then seal. Take care to confirm that the sample container is sealed properly and does not leak. The container will be labeled with a unique identifier, the date and time the sample was taken and the analysis that is required.
9. If a dipper is required, a clean grab container will be placed in the approximate middle of observed flow. After the container has been filled, retrieve and swirl its contents to ensure that all surfaces of the container are covered and rinsed thoroughly and then dumped out downstream of the sampling location. Follow this method for a total of three times, ensuring that the grab container is fully rinsed.
10. Use grab container a fourth time to collect a final sample for analysis.
11. Place laboratory sample containers for bacteria and pollutants of concern into a cooler filled with ice.
12. Fill out chain-of-custody (COC) form for laboratory samples including the unique identifier, date, time, sample matrix, sampler's initials, and required test information. The COC will remain with the samples at all times.
13. Conduct in-situ field tests using the remaining water in the grab container. Use test kits, test strips and field meter (rinse similar to dipper) for most parameters (**See Table 6-2).** All results will be recorded.
14. Samples for laboratory analysis will remain on ice until they are accepted by the laboratory. Samples must be analyzed within specific hold times for each parameter.
15. Upon completion of all sampling, or portion of sampling as the 8-hour bacteria hold time allows, the samples will be delivered to the laboratory. The samples must be signed over to the laboratory using the chain-of -custody (COC). Retain a carbon copy of the COC while the original will remain with the samples.
16. Dispose of used test kit ampules properly.
17. Decontaminate all testing personnel and equipment.

In the event that an outfall is submerged, either partially or completely, or inaccessible, field staff will proceed to the first accessible upstream manhole or structure for the observation and sampling and report the location with the screening results. Field staff will continue to the next upstream structure until there is no longer an influence from the receiving water on the visual inspection or sampling.

Field test kits or field instrumentation are permitted for all parameters except indicator bacteria and any pollutants of concern. Field kits need to have appropriate detection limits and ranges. **Table 6-2** lists various field test kits and field instruments that can be used for outfall sampling associated with the 2016 MS4 Permit parameters, other than indicator bacteria and any pollutants of concern. Analytic procedures and user's manuals for field test kits and field instrumentation are provided in **Appendix D**.

Table 6-2. Sampling Parameters and Analysis Methods

Analyte or Parameter	Instrumentation (Portable Meter)	Field Test Kit
Ammonia	CHEMetrics™ V-2000 Colorimeter Hach™ DR/890 Colorimeter Hach™ Pocket Colorimeter™ II	CHEMetrics™ K-1410 CHEMetrics™ K-1510 (series) Hach™ NI-SA Hach™ Ammonia Test Strips
Surfactants (Detergents)	CHEMetrics™ I-2017	CHEMetrics™ K-9400 and K-9404 Hach™ DE-2
Chlorine	CHEMetrics™ V-2000, K-2513, I-2001 Hach™ Pocket Colorimeter™ II	NA
Conductivity	CHEMetrics™ I-1200 YSI Pro30 YSI EC300A Oakton 450 Oakton PCTSTestr 50	NA
Temperature	YSI Pro30 YSI EC300A Oakton 450 Oakton PCTSTestr 50	NA
Salinity	YSI Pro30 YSI EC300A Oakton 450 Oakton PCTSTestr 50	NA
Temperature	YSI Pro30 YSI EC300A Oakton 450 Oakton PCTSTestr 50	NA
Indicator Bacteria: *E. coli* (freshwater) or Enterococcus (saline water)	EPA certified laboratory procedure (40 CFR § 136)	NA
Pollutants of Concern[1]	EPA certified laboratory procedure (40 CFR § 136)	NA

[1] Where the discharge is directly to impaired waters the sample must be analyzed for the pollutant(s) of concern identified as the cause of the water quality impairment. For this plan, outfalls discharging within 350' of impaired waters segments (as mapped by MassDEP) are considered direct discharges.

Testing for indicator bacteria and any pollutants of concern must be conducted using analytical methods and procedures found in 40 CFR § 136.[3] Samples for laboratory analysis must also be stored and preserved in accordance with procedures found in 40 CFR § 136. **Table 6-3** lists analytical methods, detection limits, hold times, and preservatives for laboratory analysis of dry weather sampling parameters.

Table 4-3. Required Analytical Methods, Detection Limits, Hold Times, and Preservatives[4]

Analyte or Parameter	Analytical Method	Detection Limit	Max. Hold Time	Preservative
Ammonia	Direct Nesslerization	0.05 mg/L	28 days	Cool ≤6°C, H_2SO_4 to pH <2, No preservative required if analyzed immediately
Surfactants	Methylene Blue	0.01 mg/L	48 hours	Cool ≤6°C
Chlorine	DPD	0.02 mg/L	Analyze within 15 minutes	None Required
Temperature	**N/A**	N/A	Immediate	None Required
Specific Conductance	**N/A**	0.2 µs/cm	28 days	Cool ≤6°C
Salinity	**N/A**	N/A	28 days	Cool ≤6°C
Indicator Bacteria: *E. coli* Enterococcus	*E. coli* **EPA**: 1603 **SM**: 9221B, 9221F, 9223 B **Other**: Colilert ®, Colilert-18® *Enterococcus* **EPA**: 1600 **SM**: 9230 C	*E. coli* **EPA**: 1 cfu/100mL **SM**: 2 MPN/100mL **Other**: 1 MPN/100mL *Enterococcus* **EPA**: 1 cfu/100mL **SM**: 1 MPN/100mL **Other**: 1 MPN/100mL	8 hours	Cool ≤10°C, 0.0008% $Na_2S_2O_3$

[3] 40 CFR § 136: http://www.ecfr.gov/cgi-bin/text-idx?SID=b3b41fdea0b7b0b8cd6c4304d86271b7&mc=true&node=pt40.25.136&rgn=div5

Analyte or Parameter	Analytical Method	Detection Limit	Max. Hold Time	Preservative
	Other: Enterolert®			
Total Phosphorus	**EPA**: Manual-365.3, Automated Ascorbic acid digestion-365.1 Rev. 2, ICP/AES4-200.7 Rev. 4.4 **SM**: 4500-P E-F	**EPA**: 0.01 mg/L **SM** : 0.01 mg/L	28 days	Cool ≤6°C, H_2SO_4 to pH <2
Total Nitrogen*	**EPA**: Cadmium reduction (automated)-353.2 Rev. 2.0, **SM**: 4500-NO_3 E-F	**EPA**: 0.05 mg/L **SM**: 0.05 mg/L	28 days	Cool ≤6°C, H_2SO_4 to pH <2

SM = Standard Methods

* Ammonia + Nitrate/Nitrite, methods are for Nitrate-Nitrite and need to be combined with Ammonia listed above.

Documents and Records:

Data quality objectives are as follows:

- Data must have sufficient detail in order to assess water quality at each of the sampling locations.
- Data should be representative of the actual conditions at the sampling location.
- Data should be generated through accepted sampling methodologies.
- Data must be duplicable and accurate.

Precision: Precision is the ability of a measurement to be consistently reproduced. The overall sampling precision will be determined by the collection and analysis of field duplicate samples that are not identified as such to the analytical laboratory. Duplicate samples will be taken every tenth sample at the same time as the parent sample and will be assigned a unique identifier. Due to the living nature of bacteria, they may reproduce and die after sample collection. With this in mind, a degree of disparity between the duplicate sample and the original sample is expected and is not necessarily reflective of sample collection or laboratory error.

Accuracy: Accuracy is the degree to which the result of a measurement, calculation, or specification conforms to its "true" value. In order to provide sufficient accuracy, minimization of false positive and false negative analytical data is attempted. The potential for false positive data values will be assessed through the analysis of laboratory blanks. All samples will be analyzed with a laboratory blank. Blank samples must have results of less than the method detection limit (MDL) or instrument detection limit. Laboratory control samples and calibration standards will be used by the laboratory, as needed.

Representativeness: Sample collection is intended to provide data representative of actual conditions at particular sampling locations. To achieve representativeness, sampling is carried out so as to eliminate, as much as possible, the possibility of cross-contamination between the sampled locations and non-sampled locations as well as between multiple sampling locations. However, grab samples are only

representative of a snapshot of water quality conditions at a given time. As such, they may not be representative of long-term conditions. Data collected must be evaluated with this limitation in mind.

Calibration: SDE will calibrate its multi-parameter meters in accordance with the manufacturer's specifications.

Trip Blank: One blank sample will be collected per trip to the laboratory. Before any samples are taken, a trip blank will be created, using clean water, and will remain in the same cooler as the samples for the duration of their trip to the laboratory.

QC Criteria: QC criteria are specified in **Table 6-4**. Data not meeting the criteria will be reviewed by the Project Manager. Data that does not meet laboratory QA/QC criteria will be flagged by the laboratory.

Instrument/Equipment Testing and Maintenance: Sampling supplies will be inspected prior to mobilization to ensure that everything is in good working order and that it is properly calibrated.

Table 6-4. Analytical References and Quality Control Goals

Parameter	Lab/Equipment	Reporting Limits	Method	Water Quality Criteria or Guidelines	Precision	Accuracy	Completeness
pH	Oakton Multi-Parameter PCTSTestr 50	0 - 14	NA	6.5 – 8.3	0.02	+/- 0.1	90%
Temperature	Oakton Multi-Parameter PCTSTestr 50	0 – 50 °C	NA	28.3	0.1 °C	+/- 0.5 °C	90%
Specific Conductivity	Oakton Multi-Parameter PCTSTestr 50	0 - 1999 µS/cm 2.00 to 20.00 mS/cm	NA	NA	5 µS/cm	+/- 1% F.S.	90%
Salinity	Oakton Multi-Parameter PCTSTestr 50	0 – 999 ppm 1.00 – 10.00 ppt	NA	NA	30% RPD	+/- 1% F.S.	90%
Ammonia	CHEMets Kit K-1510	0.02 mg/L	NA	0.5 mg/L	0.05 mg/L	+/- 20%	90%
Chlorine	CHEMets Kit I-2001	0.02 mg/L	NA	NA	0.02 mg/L	+/- 20%	90%
Surfactants	CHEMets Kit K-9400	0.125 mg/L	NA	0.25 mg/L	0.125 mg/L	+/- 20%	90%
E. Coli	Laboratory	>10 CFU/ 100 mL	1603	235 CFU/100 mL	30% RPD	NA	90%
Enterococcus	Laboratory	10 CFU / 100 mL	1600	104 CFU/100 mL	30% RPD	NA	90%

NA = Not Applicable
CFU = Colony Forming Unit
F.S. = Full scale
mL = Millilieter
mg/L = Milligrams per Liter
NTU = Nephelometric Turbidity Units
RPD = Relative Percent Difference

Follow-up Ranking of Outfalls and Interconnections

The Town will update and re-prioritize the initial outfall and interconnection rankings based on information gathered during dry weather screening. The rankings will be updated periodically as dry weather screening information becomes available, but will be completed within three (3) years of the effective date of the permit (July 1, 2021).

Outfalls/interconnections where relevant information was found indicating sewer input to the MS4 or sampling results indicating sewer input are highly likely to contain illicit discharges from sanitary sources. Such outfalls/interconnections will be ranked at the top of the High Priority Outfalls category for investigation. Other outfalls and interconnections may be re-ranked based on any new information from the dry weather screening.

7. Catchment Investigations

Once stormwater outfalls with evidence of illicit discharges have been identified, various methods can be used to trace the source of the potential discharge within the outfall catchment area. Catchment investigation techniques include, but are not limited to, the review of maps, historic plans, and records; manhole observation; dry and wet weather sampling; video inspection; smoke testing; and dye testing. This section outlines a systematic **procedure** to investigate outfall catchments to trace the source of potential illicit discharges. All data collected as part of the catchment investigations will be recorded and reported in each annual report.

According to the new MS4 permit, the Town must record all of the following information and include it in the outfall/interconnection inventory and priority ranking:

- Unique identifier
- Receiving water
- Date of most recent inspection
- Dimensions
- Shape
- Material
- Spatial location (+-30ft)
- Physical condition
- Indicators of potential non-stormwater discharges

The general screening of each outfall should also indicate whether dry- or wet-weather flow was present so that the outfall may be marked for further observation. The Town has separate SOPs for dry- and wet-weather outfall screening.

This procedure must begin for Problem Outfalls no later than July 1, 2020. The procedure must be complete for Problem Outfalls by July 1, 2025. Investigations for High and Low Priority outfalls shall be completed according to the priority ranking of outfalls in the Town's written IDDE program. Investigations of catchments associated with all Problem, High and Low priority outfalls shall be completed by July 1, 2028.

System Vulnerability Factors

System vulnerability factors will allow investigators to identify issues in the catchment that cause the catchment to have a higher potential for illicit connections. The MS4 permit requires the Town to report on the presence of any of the following:

- History of SSOs, including, but not limited to, those resulting from wet weather, high water table, or fat/oil/grease blockages;
- Common or twin-invert manholes serving storm and sanitary sewer alignments;
- Common trench construction serving both storm and sanitary sewer alignments;
- Crossings of storm and sanitary sewer alignments where the sanitary system is shallower than the storm drain system;
- Sanitary sewer alignments known or suspected to have been constructed with an underdrain system;
- Inadequate sanitary sewer level of service resulting in regular surcharging, customer backups, or frequent customer complaints;
- Areas formerly served by combined sewer systems;
- Sanitary sewer infrastructure defects such as leaking service laterals, cracked, broken, or offset sanitary infrastructure, directly piped connections between storm drain and sanitary sewer infrastructure, or other vulnerability factors identified through Inflow/Infiltration analyses, Sanitary Sewer Evaluation Surveys, or other infrastructure investigations.

EPA also recommends inclusion of the following system vulnerability factors. The presence of these factors will be noted when information is available.

Sewer pump/lift stations, siphons, or known sanitary sewer restrictions where power/equipment failures or blockages could readily result in SSOs;

- Any sanitary sewer and storm drain infrastructure greater than 40 years old;
- Widespread code-required septic system upgrades required at property transfers;
- History of multiple Board of Health actions addressing widespread septic system failures.

Catchments with at least one System Vulnerability Factor will be subject to wet weather screening.

Catchment Investigation for All Outfalls

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

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

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

For all catchments identified for investigation, during dry weather, field crews will systematically inspect **key junction manholes** for evidence of illicit discharges. This program involves progressive inspection and sampling at manholes in the storm drain network to isolate and eliminate illicit discharges.

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

1. By working progressively up from the outfall and inspecting key junction manholes along the way, or
2. By working progressively down from the upper parts of the catchment toward the outfall.

For most catchments, manhole inspections will proceed from the upper parts of the catchment moving down the system towards the outfall.

However, the decision to move up or down the system depends on the nature of the drainage system and the surrounding land use and the availability of information on the catchment and drainage system.

Moving up the system can begin immediately when an illicit discharge is detected at an outfall, and only a map of the storm drain system is required. Moving down the system requires more advance preparation and reliable drainage system information on the upstream segments of the storm drain system but may be more efficient if the sources of illicit discharges are believed to be located in the upstream portions of the catchment area.

Once a manhole inspection methodology has been selected, investigations will continue systematically through the catchment. Generalized catchment investigation procedures follow below. The Town's contractor for catchment investigation work will provide detailed investigation procedures before catchment investigations are scheduled to begin.

Catchment Investigation Procedure

1. **Gather data**. Identify maps, historic plans and records, and other sources of data about the catchment. This data should be used to refine the catchment delineation and to identify system vulnerability factors within each catchment.

   Data might include but is not limited to: current GIS information; plans related to the construction of storm and sanitary sewers, Board of Health data on septic systems; complaint records; sanitary sewer surcharges; and septic system breakouts.

   For each catchment, this data will be recorded digitally. When the presence of a System Vulnerability Factor is noted, the field crew will move to the next section ("For catchments with a minimum of one SVF identified").

2. **Inspect the catchment's key junction manhole.** During dry weather, open key junction manholes in the catchment and inspect. If no key junction manholes are present in the catchment, record this information and proceed to *For Catchments not Containing Junction Manholes* below.
   a. Conduct a rapid visual and olfactory inspection to attempt to identify source(s) of illicit connections.
   b. If visual evidence of a direct illicit discharge is identified skip to step e.
   c. If flow is observed, a sample will be collected and analyzed at a minimum for ammonia, chlorine, and surfactants. Field test kits can be used for these analyses. In-situ screening should also be conducted for specific conductivity, pH, temperature and salinity. Record the results.
   d. If flow is not observed, an obstruction (sandbag) will be placed in the manhole to capture intermittent flows. After at least 48 hours the sandbag will be checked. If flow is captured, then it will be analyzed for the same parameters listed above.
   e. Record any evidence of illicit connections, such as visual evidence of toilet paper or sewage, bacterial growth, odor, etc. If evidence is observed, flag the area draining to the junction manhole for further investigation.
   f. Continue the process of key junction manhole inspections until a sample result indicates suspected illicit discharges are isolated to as short a pipe segment as possible, ideally a single segment between two manholes.
   g. After identifying a pipe segment with suspected illicit discharges, additional key junction manhole inspections can be conducted downstream to confirm that there are not significant increases in pollutant indicators present. If there are significant increases this could be indicative of additional illicit connections.
   h. Conduct investigations in other "tributary" portions of the collection system.
   i. Identify any System Vulnerability Factors present at the manhole, if any manholes are present. If an SVF is identified, continue to *For Catchments with SVFs Present* below.

Key junction and subsequent manhole investigations will proceed until the location of suspected illicit discharges or SSOs can be isolated to a pipe segment between two manholes.

If no evidence of an illicit discharge is found, catchment investigation will be considered complete upon completion of key junction manhole sampling.

For Catchments with SVFs Present

1. **Complete procedure for all outfalls.** Data gathering and field inspection of key junction manholes should be complete for a catchment before moving to investigation of SVFs.
2. **Conduct wet weather screening.** The purpose of these inspections is to sample during wet weather to determine whether wet weather induced high flows in sanitary sewers or high groundwater in areas served by septic systems result in discharges of sanitary flow to the MS4.

a. Conduct at least one wet weather screening and sampling at the outfall that includes the following parameters (see permit p. 36 for details). EPA recommends sampling during Spring when groundwater levels are relatively high.
    - Ammonia
    - Chlorine
    - Conductivity
    - Salinity
    - E. coli or enterococcus
    - Surfactants
    - Temperature
    - Pollutants of concern (in Milton's case, often phosphorus)

b. There is no required minimum rainfall event for wet weather screening as long as runoff is produced but avoid screening during initial discharge period ("first flush").

For Catchments not Containing Junction Manholes

For catchments that do not contain junction manholes, dry weather screening and sampling will satisfy permit requirements for catchment investigation. If dry weather screening reveals no dry weather flow, no evidence of illicit discharges or SSOs is indicated through sampling results or visual or olfactory means, and no wet weather System Vulnerability Factors are identified, investigations in these catchments may be considered complete.

If dry weather screenings in these catchments indicate potential presence of illicit discharges, the catchment must be further investigated as detailed in the *Identifying and Confirming Illicit Sources* section.

8. Identifying and Confirming Illicit Sources

If the potential presence of an illicit discharge is observed during dry weather screening of an outfall, follow the procedure detailed in this section. In general, the process of identifying, tracing, and locating an illicit discharge will follow the flow shown in figure 7-1.

Move upstream from the point of observation to identify the source of the discharge, using the system mapping to determine infrastructure, tributary pipes, and drainage areas that contribute. At each point, survey the general area and surrounding properties to identify potential sources of the illicit discharge. Document observations at each point. Photographs may also be useful documentation.

Continue this process until the illicit discharge is no longer observed, which will define the boundaries of the likely source. For example, if the illicit discharge is present in catch basin 137 but not the next upstream catch basin, 138, the source of the illicit discharge is between these two structures.

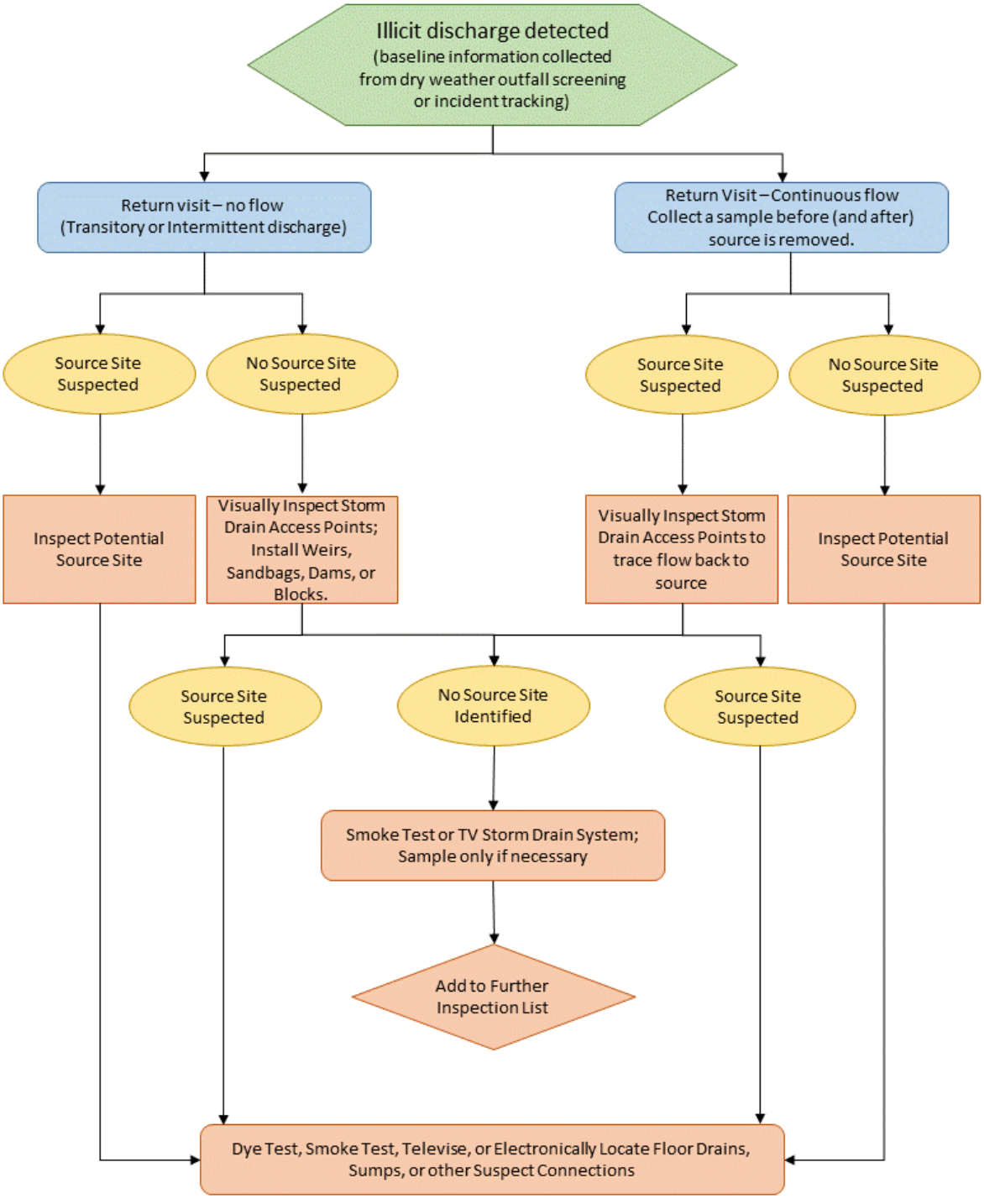
Once the source of an illicit discharge is approximated between two manholes, more detailed investigation techniques will be used to isolate and confirm the source of the illicit discharge. The following methods may be used in isolating and confirming the source of illicit discharges:

- Sandbagging
- Smoke Testing
- Dye Testing
- CCTV/Video Inspections
- Optical Brightener Monitoring

These methods are described in more detail in this section.

Public notification is an important aspect of a detailed source investigation program. Prior to smoke testing, dye testing, or TV inspections, the Department of Public Works will notify property owners in the affected area. Notification may include letters, door hangers, reverse 911 calls, or other methods for single family homes, and businesses. Additional notification will be posted in building lobbies for multi-family dwellings.

Figure 7-1. Flow Chart to Select Tracing Techniques.



Sandbagging

This technique can be particularly useful when attempting to isolate intermittent illicit discharges or those with very little perceptible flow. The technique involves placing sandbags or similar barriers (e.g., caulking, weirs/plates, or other temporary barriers) within inlets to manholes to form a temporary dam that collects any intermittent flows that may occur. Following 24 hours of dry weather, sandbags are typically installed and left in place for 48 hours. Because at least 72 hours of dry weather are required for sandbagging, sandbags should only be installed when dry weather is forecasted.

If flow has collected behind the sandbags/barriers after 48 hours, the flow can be assessed using visual observations or by sampling. If no flow collects behind the sandbag, the upstream pipe network can be ruled out as a source of the intermittent discharge. Finding appropriate durations of dry weather and the need for multiple trips to each manhole makes this method both time-consuming and somewhat limiting.

Smoke Testing

Smoke testing involves injecting non-toxic smoke into drain lines and noting the emergence of smoke from sanitary sewer vents in illegally connected buildings or from cracks and leaks in the system itself. Typically, a smoke bomb or smoke generator is used to inject the smoke into the system at a catch basin or manhole and air is then forced through the system. Test personnel are place in areas where there are suspected illegal connections or cracks/leaks, noting any escape of smoke (indicating an illicit connection or damaged storm drain infrastructure). It is important when using this technique to make proper notifications to area residents and business owners as well as local police and fire departments.

If the initial test of the storm drain system is unsuccessful then a more thorough smoke test of the sanitary sewer lines can also be performed. Unlike storm drain smoke tests, buildings that do not emit smoke during sanitary sewer smoke tests may have problem connections and may also have sewer gas venting inside, which is hazardous.

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

Dye Testing

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

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

The test can be relatively quick (typically less than 30 minutes per test), effective (results are usually definitive), and inexpensive. Dye testing is best used when the likely source of an illicit discharge has been narrowed down to a few specific houses or businesses.

CCTV/Video Inspection

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

Optical Brightener Monitoring

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

9. Illicit Discharge Removal

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

- The location of the discharge and its source(s)
- A description of the discharge
- The method of discovery
- Date of discovery
- Date of elimination, mitigation or enforcement action OR planned corrective measures and a schedule for completing the illicit discharge removal
- Estimate of the volume of flow removed.

Confirmatory Outfall Screening

Within one (1) year of removal of all identified illicit discharges within a catchment area, confirmatory outfall or interconnection screening will be conducted. The confirmatory screening will be conducted in dry weather unless System Vulnerability Factors have been identified, in which case both dry weather and wet weather confirmatory screening will be conducted. If confirmatory screening indicates evidence of additional illicit discharges, the catchment will be scheduled for additional investigation.

10.Ongoing Screening

Upon completion of all catchment investigations and illicit discharge removal and confirmation (if necessary), each outfall or interconnection will be re-prioritized for screening and scheduled for ongoing screening once every five (5) years. Ongoing screening will consist of dry weather screening and sampling consistent with the procedures described and included in this plan. Ongoing wet weather screening and sampling will also be conducted at outfalls where wet weather screening was required due to System Vulnerability Factors and will be conducted in accordance with the procedures described and included in this plan. All sampling results will be reported in the annual report.

11. Training

Annual IDDE training will be made available to all employees involved in the IDDE program. This training will at a minimum include information on how to identify illicit discharges and SSOs and may also include additional training specific to the functions of particular personnel and their function within the framework of the IDDE program. Training records will be maintained in **Appendix D**. The frequency and type of training will be included in the annual report.

12. Progress Reporting

The progress and success of the IDDE program will be evaluated on an annual basis. The evaluation will be documented in the annual report and will include the following indicators of program progress:

- Number of SSOs and illicit discharges identified and removed
- Number and percent of total outfall catchments served by the MS4 evaluated using the catchment investigation procedure
- Number of dry weather outfall inspections/screenings
- Number of wet weather outfall inspections/sampling events
- Number of enforcement notices issued
- All dry weather and wet weather screening and sampling results
- Estimate of the volume of sewage removed, as applicable
- Number of employees trained annually.

The success of the IDDE program will be measured by the IDDE activities completed within the required permit timelines.

Appendix A: Legal Authority

The 2003 MS4 permit requires that the Town of Milton have an ordinance including adequate legal authority for the Town to prohibit, investigate, and eliminate illicit discharges, as well as appropriate enforcement procedures and actions. Below are excerpts from Milton's Sewer Regulation outlining IDDE authority.

Authority prohibiting illicit discharges:

Sec. 2-3. Use of Public Sewers Required

a) "Unlawful Discharges – It shall be unlawful to discharge any polluted water without the applicable state and federal permits.
b) Board Approval of Discharges – It shall be unlawful to discharge any wastes, Sewage, or Industrial Wastes to a Natural Outlet without the proper treatment and without prior approval by the Board [of Selectmen].
c) Connection to Public Sewers Required – The owners of all houses, buildings, or properties used for human occupancy, employment, recreations, or other purposes, situated within the Town and abutting on any street, alley, easement or right-of-way in which there is now located or may in the future be located a public sewer of the Town, are hereby required at their expense to install suitable toilet facilities therein, and to connect such facilities directly with the proper public sewer in accordance with the provisions of these regulations within ninety (90) days after date of receipt of official notice from the Board of Health of the Town of Milton acting under the provisions Title 5 of the "State Environmental Code for the Commonwealth of Massachusetts, Minimum Requirements, for the Subsurface Disposal of Sanitary Sewage" or regulations relative thereto, provided that the public sewer is within five hundred (500) feet of the property line. Said connections shall be made without exception, unless for reasons as determined by the Town of Milton Board of Health. Any person failing to connect, if required, within the time limit stated by the Board of Health shall be subject to a fine of not more than two hundred ($200) dollars per day, as determined by the Board. Additionally, Persons with failed cesspools or septic systems may be required to connect to the proper public Sewer within a shorter time period, as determined reasonable by the Board."

Sec. 3-8. Prohibited Connections

"No Person shall make connection of roof downspouts, foundation drains, sump pumps, areaway drains, or other sources of surface runoff or groundwater to a building sewer, which in turn is connected directly or indirectly to a Sanitary Sewer. Any persons found discharging said sources shall be subject to penalties as set forth in DIVISION 8 PENALTIES of these Regulations."

DIVISION 4 USE OF PUBLIC SEWERS

Sec. 4-1. Disposal of Unpolluted Water Prohibited

"No Person shall discharge or cause to be discharged any unpolluted waters such as stormwater, surface water, groundwater, roof or surface runoff, tidewater, subsurface drainage, uncontaminated cooling water, unpolluted process waters, non-contact cooling water, or non-contact industrial

process water to any public sanitary sewer. In general, only sanitary sewage shall be discharged to the common sewer."

Sec. 4-2. Discharge Method Specified
"Stormwater and all other unpolluted drainage shall be discharged to such Public Sewers as are specifically designated as Storm Sewers, or to a Natural Outlet approved by the Board. Industrial cooling water or unpolluted process waters may be discharged, on approval of the Board, to a Storm Sewer or Natural Outlet.

Sec. 4-3. Prohibited Wastes
"No Person shall discharge, or cause to be discharged, substances, materials, waters, or wastes if it appears likely, in the opinion of the Director that such wastes are likely, either by themselves or by interaction with other substances: (1)To harm either the sewerage system or the wastewater treatment process or equipment, (2) to be otherwise incompatible with the treatment process, (3) to affect receiving waters, (5) to endanger life, limb, or property or (6) to constitute a nuisance. Nor shall any person discharge the following described substances, waters, or wastes: […]"

Authority granting power to investigate illicit discharges:

Sec. 3-20. Inspection Powers of the Director and Authority
"The Director, the Authority, and their duly authorized agents bearing proper credentials and identification shall be permitted to enter, at reasonable times, all properties connected with the Public Sewers for the purposes of inspection, observation, measurement, sampling, and testing, all in provisions of these Regulations. They may inquire into any processes with the provisions of these Regulations. They may inquire into any processes including metallurgical, chemical, oil, refining, ceramic, paper, plating, or other industrial activity that contribute waters or wastes to the Public Sewers […]."

Sec. 7-1. Permission for Inspection
"The Director, Board, and other duly authorized employees of the Town or the Authority bearing proper credentials and identification shall be permitted to enter, at reasonable times, all properties connected with the public sewers for the purposes of inspection, observation, measurement, repair, maintenance, sampling, and testing pertinent to discharge to the wastewater facilities in accordance with the provisions of these regulations.[…]"

Authority granting power to enforce regulation and require elimination of illicit discharges:

"**DIVISION 8 PENALTIES**

Sec. 8-1. Written Notice of Violation.
Whenever on the basis of information available to it, the Town finds any person found to be violating any provision of this Regulation, except Article VI, the Town may take any or all of the following actions:

a) Issue an order to cease and desist any such violation;

b) Issue an implementation schedule ordering specific actions to be taken together with time and schedule requirements;
c) Bring a civil or criminal action as provided by law;
d) Take any action available to it under federal, state, or local laws or regulations.

Sec. 8-2. Penalty for Continued Violation
Any person who shall continue any violation beyond the time and schedule requirements provided for in Article IX, Section 1, shall be charged with a misdemeanor and on conviction thereof shall be fined in the amount not exceeding three hundred ($300.00) dollars for each violation. Each day in which any such violation shall continue shall be deemed a separate offense. If the violation continues, the board shall direct the Town Counsel to seek an injunction in the Superior Court of the Commonwealth of Massachusetts requiring the offender to cease all violations. Violations may result in the revocation of Town licenses. This provision may be enforced through non-criminal disposition.

In addition, and not in lieu of a fine, any person violating any of the provisions of this ordinance shall be subject to a civil penalty up to $5,000.00 for each violation, as provided by G.L. c.83, 10. Each day a violation shall continue shall be deemed a separate offense.

A system of sewer use charges together with suitable procedures for monitoring and enforcing compliance with sewer use regulations shall be set after a public hearing.

Users resident in the Town of Milton and non-resident users metered to the Department shall be assessed user charges with water usage as measured by the Department.

Users not metered by the Town of Milton shall be assessed user fees as measured by water usage provided by the public water system which provides their service, if applicable, or if not connected to any public water system, then such measurement shall be made by estimation of the average of five comparable users.

All Town Departments and all county, state, and municipal buildings shall be responsible for payment of user fees assessed in accordance with water usage.

Users of Town property including tenants and lessees shall be responsible for payment of user fees assessed in accordance with water usage.

Sec 8-3. Surcharge
Any person found to be discharging unpolluted waters, as described in Article IV, Section 2, shall be subject to a non-refundable surcharge in an amount to be determined by the Director. The amount shall be based on the current sewer rates and the estimated flow of the unpolluted water discharged.

Sec. 8-4. Liability
Any Person violating any provisions of this ordinance shall become liable to the Town and/or the Authority for any expense, loss, or damage occasioned by Town or the Authority by reason of such offense.

Appendix B: Storm Sewer System Mapping

The Town's full storm sewer system map may be found at https://www.mapsonline.net/miltonma/miltonofficialmapper.html . Select the "Drainage" layer to view the system map.

Appendix C: Water Quality Analysis Instructions, User's Manuals and Standard Operating Procedures

Includes:

- Dry Weather Outfall Inspection SOP
- Sample Dry Weather Outfall Inspection form
- Water Quality Screening in the Field SOP
- Sample Water Quality Screening form
- Sample Analytical Testing Results form

DRY WEATHER OUTFALL INSPECTION

Introduction

Outfalls from an engineered storm drain system can be in the form of pipes or ditches. Under current and pending regulations, it is important to inspect and document water quality from these outfalls under both dry weather and wet weather conditions. A separate SOP, "Wet Weather Outfall Inspection", covers the objectives of that type of inspection. This SOP discusses only dry weather inspections.

During a dry weather period, it is anticipated that minimal flow from stormwater outfalls will be observed. Therefore, dry weather inspections aim to characterize any/all flow observed during a dry weather period and identify potential source(s) of an illicit discharge through qualitative testing; further described in SOP "Water Quality Screening in the Field".

Objectives of Dry Weather Inspections

A dry weather period is a time interval during which less than 0.1 inch of rain is observed across a minimum of 72 hours. Unlike wet weather sampling, dry weather inspections are not intended to capture a "first flush" of stormwater discharge, rather they are intended to identify any/all discharges from a stormwater outfall during a period without recorded rainfall. The objective of inspections during a dry weather period is to characterize observed discharges and facilitate detection of illicit discharges.

Visual Condition Assessment

The attached Dry Weather Outfall Inspection Survey is a tool to assist in documenting observations related to the both quantitative and qualitative characteristics of any/all flows conveyed by the structure during a dry period.

For any visual observation discharge from a stormwater outfall, an investigation into the pollution source should occur, but the following are often true:

1. Foam: indicator of upstream vehicle washing activities, or an illicit discharge.
2. Oil sheen: result of a leak or spill.
3. Cloudiness: indicator of suspended solids such as dust, ash, powdered chemicals and ground up materials.
4. Color or odor: Indicator of raw materials, chemicals, or sewage.
5. Excessive sediment: indicator of disturbed earth of other unpaved areas lacking adequate erosion control measures.
6. Sanitary waste and optical enhancers (fluorescent dyes added to laundry detergent): indicators of illicit discharge.
7. Orange staining: indicator of high mineral concentrations.

Both bacteria and petroleum can create a sheen on the water surface. The source of the sheen can be differentiated by disturbing it, such as with a pole. A sheen caused by oil will remain intact and move in a swirl pattern; a sheen caused by bacteria will separate and appear "blocky". Bacterial or naturally occurring sheens are usually silver or relatively dull in color and will break up into a number of small patches of sheen. The cause may be presence of iron, decomposition of organic material or presence of certain bacteria. Bacterial sheen is not a pollutant but should be noted.

Many of these observations are indicators of an illicit discharge. Examples of illicit discharges include: cross-connections of sewer services to engineered storm drain systems; leaking septic systems; intentional discharge of pollutants to catch basins; combined sewer overflows; connected floor drains; and sump pumps connected to the system (under some circumstances). Additional guidelines for illicit discharge

investigations are included in SOP “Locating Illicit Discharges”. If dry weather flow is present at the outfall, and the flow does not appear to be an obvious illicit discharge (e.g. flow is clear, odorless, etc.) attempt to identify the source of flow (e.g. intermittent stream, wetlands drainage, etc.) and document the discharge for future comparison.

Although many of the observations are indicators of illicit discharge it should be noted that several of these indicators may also occur naturally. Orange staining may be the result of naturally occurring iron, and thus unrelated to pollution. Foam can be formed when the physical characteristics of water are altered by the presence of organic materials. Foam is typically found in waters with high organic content such as bog lakes, streams that originate from bog lakes, productive lakes, wetlands, or woody areas. To determine the difference between natural foam and foam cause by pollution, consider the following:

1. Wind direction or turbulence: natural foam occurrences on the beach coincide with onshore winds. Often, foam can be found along a shoreline and/or on open waters during windy days. Natural occurrences in rivers can be found downstream of a turbulent site.
2. Proximity to a potential pollution source: some entities including the textile industry, paper production facilities, oil industries, and fire fighting activities work with materials that cause foaming in water. If these materials are released to a water body in large quantities, they can cause foaming. Also, the presence of silt in water, such as from a construction site can cause foam.
3. Feeling: natural foam is typically persistent, light, not slimy to the touch.
4. Presence of decomposing plants or organic material in the water.

Optical enhancers, fluorescent dyes added to laundry detergent, are typically detected through the use of clean, white cotton pads placed within the discharge for several days, dried then viewed under a UV light. If the cotton pad displays fluorescent patches, optical enhancers are present. Optical enhancers are occasionally visible as a bluish-purple haze on the water surface; however the testing method should be used to confirm the presence of optical enhancers.

The Dry Weather Outfall Inspection Survey includes fields where these and other specific observations can be noted. The inspector shall indicate the presence of a specific water quality indicator or parameter by marking “Yes”. If “Yes” is marked, provide additional details in the comments section. If the indictor in question is not present, mark “No”.

Within the comments section, provide additional information with regard to recorded precipitation totals, or more detailed descriptions of observations made during the inspection and corrective actions taken.

Measuring Water Quality

Based on the results of the Visual Condition Assessment, it may be necessary to collect additional data about water quality. Water quality samples can be in the form of screening using field test kits and instrumentation, or by discrete analytical samples processed by a laboratory.

Information on selecting and using field test kits and instrumentation is included in another SOP, “Water Quality Screening in the Field.” The Inspection Survey also provides values for what can be considered an appropriate benchmark for a variety of parameters that can be evaluated in the field.

If the results of screening using field test kits indicate that the outfall’s water quality exceeds the benchmarks provided, collection of discrete analytical samples should be considered.

Analytical Sample Collection

Sample collection methods may vary based on specific outfall limitations, but shall follow test procedures outlined in 40 CFR 136. A discrete manual or grab sample can classify water at a distinct point in time. These samples are easily collected and used primarily when the water quality of the discharge is expected to be homogeneous, or unchanging, in nature. A flow-weighted composite sample will classify water quality over a measured period of time. These samples are used when the water quality of the discharge is expected to be heterogeneous, or fluctuating, in nature. Grab samples are more common for dry weather outfall inspections due to the time-sensitive nature of the process.

Protocols for collecting a grab sample shall include the following:

1. Do not eat, drink or smoke during sample collection and processing.
2. Do not collect or process samples near a running vehicle.
3. Do not park vehicles in the immediate sample collection area, including both running and non-running vehicles.
4. Always wear clean, powder-free nitrile gloves when handling sample containers and lids.
5. Never touch the inside surface of a sample container or lid, even with gloved hands.
6. Never allow the inner surface of a sample container or lid to be contacted by any material other than the sample water.
7. Collect samples while facing upstream and so as not to disturb water or sediments in the outfall pipe or ditch.
8. Do not overfill sample containers, and do not dump out any liquid in them. Liquids are often added to sample containers intentionally by the analytical laboratory as a preservative or for pH adjustment.
9. Slowly lower the bottle into the water to avoid bottom disturbance and stirring up sediment.
10. Do not allow any object or material to fall into or contact the collected water sample.
11. Do not allow rainwater to drip from rain gear or other surfaces into sample containers.
12. Replace and tighten sample container lids immediately after sample collection.
13. Accurately label the sample with the time and location.
14. Document on the Wet Weather Outfall Inspection Survey that analytical samples were collected, specify parameters, and note the sample time on the Inspection Survey. This creates a reference point for samples.

Analytical Sample Quality Control and Assurance

Upon completion of successful sample collection, the samples must be sent or delivered to a MassDEP-approved laboratory for analytical testing. Quality control and assurance are important to ensuring accurate analytical test results. Sample preservation is required to prevent contaminate degradation between sampling and analysis, and should be completed in accordance with 40 CFR 136.3.

Maximum acceptable holding times are also specified for each analytical method in 40 CFR 136.3. Holding time is defined as the period of time between sample collection and extraction for analysis of the sample at the laboratory. Holding time is important because prompt laboratory analysis allows the laboratory to review the data and if analytical problems are found, re-analyze the affected samples within the holding times.

Chain of custody forms are designed to provide sample submittal information and document transfers of sample custody. The forms are typically provided by the laboratory and must be completed by the field sampling personnel for each sample submitted to the lab for analysis. The document must be signed by both the person releasing the sample and the person receiving the sample every time the sample changes hands. The sampling personnel shall keep one copy of the form and send the remaining copies to the laboratory with the samples. Custody seals, which are dated, signed and affixed to the sample container, may be used if the samples are shipped in a cooler via courier or commercial overnight shipping.

Outfall ID: _____ **Town:** _____

Inspector: _____ **Date:** _____

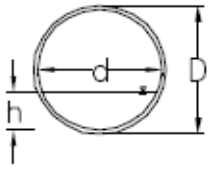
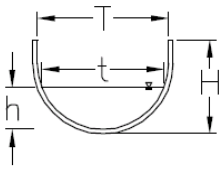
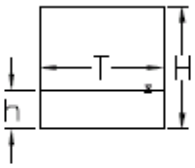
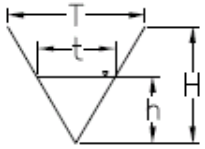
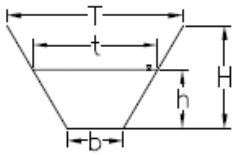
Street Name _____

Last rainfall event _____

DRY WEATHER OUTFALL INSPECTION SURVEY

Type of Outfall (check one):		**Pipe Outfall** ☐	**Open Swale Outfall** ☐
Outfall Label:	**Stencil** ☐ **Ground Inset** ☐ **Sign** ☐ **None** ☐ **Other**_____		
Pipe Material:	Concrete ☐ Corrugated metal ☐ Clay Tile ☐ Plastic ☐ Other: _____ ☐	**Pipe Condition:**	Good ☐ Poor ☐ Fair ☐ Crumbling ☐
Swale Material:	Paved (asphalt) ☐ Concrete ☐ Earthen ☐ Stone ☐ Other: _____ ☐	**Swale Condition:**	Good ☐ Poor ☐ Fair ☐ Crumbling ☐

Shape of Pipe/Swale (check one)

 ☐  ☐	 ☐	 ☐	 ☐
Rounded Pipe/Swale	**Rectangular Pipe/Swale**	**Triangular Swale**	**Trapezoidal Swale**

Pipe Measurements:	**Swale Measurements:**	**Is there a headwall?**	**Location Sketch**
Inner Dia. (in): d= _____	Swale Width (in): T= _____	Yes ☐ No ☐	
Outer Dia. (in): D= _____	Flow Width (in): t = _____	**Condition:**	
Pipe Width (in): T= _____	Swale Height (in): H= _____	Good ☐ Poor ☐ Fair ☐ Crumbling ☐	
Pipe Height (in): H= _____	Flow Height (in): h= _____*		
Flow Width (in): h= _____*	Bottom Width (in): b= _____		

Description of Flow: Heavy ☐ Moderate ☐ Trickling ☐ Dry ☐	
If the outlet is submerged check yes and indicate approximate height of water above the outlet invert. h above invert (in):	**Circle All Materials Present:**
Odor: Yes ☐ No ☐ **Optical enhancers suspected?** Yes ☐ No ☐ **Has channelization occurred?** Yes ☐ No ☐ **Has scouring occurred below the outlet?** Yes ☐ No ☐	Rip rap Excessive sediment Foam Sanitary Waste Orange Staining Sheen: Bacterial Sheen: Petroleum Floatables Algae Excessive Vegetation
Required Maintenance: Tree Work, Remove Trash/Debris, Ditch Work, Blocked Pipe, Structural Corrosion, Erosion at Structure, N/A, Other	
Comments:	

WATER QUALITY SCREENING IN THE FIELD

Introduction

Outfalls from an engineered storm drain system can be in the form of pipes or ditches. Under current and pending regulations, it is important to inspect and document water quality within the MS4 system under both dry weather and wet weather conditions. “Dry Weather Outfall Inspection” and “Wet Weather Outfall Inspection” cover the objectives of these activities and how water quality parameters can be collected during both types of inspections. “Catch Basin Inspection and Cleaning” describes how this operations and maintenance activity can serve as an additional opportunity to collect water quality data.

The SOP for wet and dry weather screenings included detailed information on how to collect discrete analytical samples to be processed by a laboratory. In contrast, this SOP addresses screening-level measurements than can be collected at outfalls, catch basins, receiving waters, or other water bodies. The measurements can be collected with field test kits or with portable meters.

Water quality screening data collected in this manner can feed into an illicit discharge detection and elimination investigation, like the process described in the “Locating Illicit Discharges” SOP.

Visual Condition Assessment

For any visual observation discharge from a stormwater outfall, an investigation into the pollution source should occur, but the following are often true:

8. Foam: indicator of upstream vehicle washing activities, or an illicit discharge.
9. Oil sheen: result of a leak or spill.
10. Cloudiness: indicator of suspended solids such as dust, ash, powdered chemicals and ground up materials.
11. Color or odor: Indicator of raw materials, chemicals, or sewage.
12. Excessive sediment: indicator of disturbed earth of other unpaved areas lacking adequate erosion control measures.
13. Sanitary waste and optical enhancers (fluorescent dyes added to laundry detergent): indicators of illicit discharge.
14. Orange staining: indicator of high mineral concentrations.

Both bacteria and petroleum can create a sheen on the water surface. The source of the sheen can be differentiated by disturbing it, such as with a pole. A sheen caused by oil will remain intact and move in a swirl pattern; a sheen caused by bacteria will separate and appear “blocky”. Bacterial or naturally occurring sheens are usually silver or relatively dull in color and will break up into a number of small patches of sheen. The cause may be presence of iron, decomposition of organic material or presence of certain bacteria. Bacterial sheen is not a pollutant but should be noted.

Many of these observations are indicators of an illicit discharge. Examples of illicit discharges include: cross-connections of sewer services to engineered storm drain systems; leaking septic systems; intentional discharge of pollutants to catch basins; combined sewer overflows; connected floor drains; and sump pumps connected to the system (under some circumstances). Additional guidelines for illicit discharge investigations are included in SOP “Locating Illicit Discharges”. If dry weather flow is present at the outfall, and the flow does not appear to be an obvious illicit discharge (e.g. flow is clear, odorless, etc.) attempt to identify the source of flow (e.g. intermittent stream, wetlands drainage, etc.) and document the discharge for future comparison.

Although many of the observations are indicators of illicit discharge it should be noted that several of these indicators may also occur naturally. Orange staining may be the result of naturally occurring iron, and thus unrelated to pollution. Foam can be formed when the physical characteristics of water are altered by the presence of organic materials. Foam is typically found in waters with high organic content such as bog lakes, streams that originate from bog lakes, productive lakes, wetlands, or woody areas. To determine the difference between natural foam and foam cause by pollution, consider the following:

5. Wind direction or turbulence: natural foam occurrences on the beach coincide with onshore winds. Often, foam can be found along a shoreline and/or on open waters during windy days. Natural occurrences in rivers can be found downstream of a turbulent site.
6. Proximity to a potential pollution source: some entities including the textile industry, paper production facilities, oil industries, and fire fighting activities work with materials that cause foaming in water. If these materials are released to a water body in large quantities, they can cause foaming. Also, the presence of silt in water, such as from a construction site can cause foam.
7. Feeling: natural foam is typically persistent, light, not slimy to the touch.
8. Presence of decomposing plants or organic material in the water.

Optical enhancers, fluorescent dyes added to laundry detergent, are typically detected through the use of clean, white cotton pads placed within the discharge for several days, dried then viewed under a UV light. If the cotton pad displays fluorescent patches, optical enhancers are present. Optical enhancers are occasionally visible as a bluish-purple haze on the water surface; however the testing method should be used to confirm the presence of optical enhancers.

If a Visual Condition Assessment indicates the presence of these pollutants, it may be necessary to quantify the extent of each, and gather data on other parameters that cannot be visually observed but can be measured using field kits or meters. These parameters include:

- Ammonia
- Chloride (present in treated drinking water but not groundwater)
- Conductivity
- Fluoride
- Hardness
- pH
- Potassium

Field Kits and Sampling Methods Available

In recent drafts of new MS4 Permits, U.S. EPA Region 1 has identified several test kits that are acceptable for use in the field, and other regulatory agencies have also completed similar reviews. The following table shows field test kits and portable meters that can be used for screening parameters.

Field Measurements, Test Kits, and Instrumentation

Analyte or Parameter	Instrumentation (Portable meter)	Field Test Kit
Ammonia	CHEMetrics™ V-2000 Colorimeter Hach™ DR/890 Colorimeter Hach™ Pocket Colorimeter™ II	CHEMetrics™ K-1410 CHEMetrics™ K-1510 (series) Hach™ NI-SA Hach™ Ammonia Test Strips
Bacteria	Bacteria field test kits require 24-hour window	

Boron	N/A	Hanna™ HI 38074 Taylor™ K-1541
Chloride	CHEMetrics™ V-2000 Colorimeter Hach™ Pocket Colorimeter™ II LaMotte™ DC1200 Colorimeter	CHEMetrics™ K-2002 through K-2070 Hach™ CDS-DT Hach™ Chloride QuanTab® Test Strips
Color		Hach™ ColorDisc
Conductivity	CHEMetrics™ I-1200	N/A
Detergents (Surfactants)	CHEMetrics™ I-2017	CHEMetrics™ K-9400 and K-9404 Hach™ DE-2
Fluoride	CHEMetrics™ V-2000 Colorimeter Hach™ Pocket Colorimeter™ II	N/A
Hardness	N/A	CHEMetrics™ K-1705 and K-1710 CHEMetrics™ K-4502 through K-4530 Hach™ HA-DT Hach™ Hardness Test Strips
Optical enhancers	Field tests still under development	
pH	CHEMetrics™ I-1000	Hach™ 17J through 17N Hach™ pH Test Strips
Potassium	Horiba™ Cardy C-131	LaMotte™ 3138 KIW
Turbidity	CHEMetrics™ I-1300	N/A

Each field test kit will include instructions specific to that test kit, and most kits are available in configurations that detect different ranges of the parameter. For example, the CHEMetrics™ detergents kit K-9400 shown above detects concentrations of 0 to 3 milligrams per liter (mg/L) while the K-9404 kit detects concentrations of 0 to 1,400 mg/L.

The table below shows values identified by the U.S. EPA and the Center for Watershed Protection as typical screening values for select parameters. These represent the typical concentration (or value) of each parameter expected to be found in stormwater. Screening values that exceed these benchmarks may be indicative of pollution and/or illicit discharges.

Benchmark Field Measurements for Select Parameters

Analyte or Parameter	Benchmark
Ammonia	>50.0 mg/L
Conductivity	>2,000
Detergents (Surfactants)	> 0.25 mg/L
Fluoride	>0.25 mg/L

pH	<5
Potassium	>20 mg/L

If and when water quality screening samples, whether using field test kits or portable meters, exceed these benchmark concentrations, the inspector should consider collecting analytical samples for laboratory analysis.

Advantages and Disadvantages of Field Testing

Field test kits can be convenient for use as a screening tool, initial purchase costs are low (typically $0.50 to $5.00 for the kits included in the Field Measurements table) and the costs are far less than full analyses at a laboratory. However, some disadvantages of this screening method include:

- Limited shelf life
- Labor cost associated with inspector's time
- Generation of wastes, including glass vials and used reagent
- Steps and processes for each kit can vary widely, resulting in errors
- Trained staff are required in order to effectively utilize kits
- Not all kits are accepted by all regulatory agencies
- Limited useful detection range

Portable instrumentation such as the colorimeters shown in the Field Measurements table have the benefit of providing accurate readings, measure to low detection limits, and can be purchased pre-programmed to measure concentrations of most parameters required. Disadvantages of portable instrumentation include:

- High initial purchase cost
- Requirement for ongoing calibration and maintenance
- Individual probes require periodic replacement
- Specific storage requirements to maintain calibration
- Trained staff are required in order to effectively utilize meters

SAMPLE WATER QUALITY SCREENING FORM

Outfall I.D.			
Outfall Location			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular ☐ Pre-Storm Event ☐ During Storm Event ☐ Post-Storm Event ☐			
Most Recent Storm Event			

FIELD WATER QUALITY SCREENING RESULTS

Sample Parameter	**Field Test Kit or Portable Instrument Meter**	**Benchmark**	**Field Screening Result**	**Full Analytical Required?**
Ammonia		> 50.0 mg/L		☐ Yes ☐ No
Boron		> 0.35 mg/L		☐ Yes ☐ No
Chloride		230 mg/L		☐ Yes ☐ No
Color		> 500 units		☐ Yes ☐ No
Specific Conductance		> 2,000 µS/cm		☐ Yes ☐ No
Detergents & Surfactants		> 0.25 mg/L		☐ Yes ☐ No
Fluoride		> 0.25 mg/L		☐ Yes ☐ No
Hardness		< 10 mg/L or > 2,000 mg/L		☐ Yes ☐ No
pH		< 5		☐ Yes ☐ No
Potassium		> 20 mg/L		☐ Yes ☐ No
Turbidity		> 1,000 NTU		☐ Yes ☐ No

SAMPLE FULL ANALYTICAL TESTING WATER QUALITY RESULTS FORM

Sample Parameter	Analytical Test Method	Sample Collection (Time/Date)	Testing Lab	Analytical Testing Result
Ammonia	EPA 350.2/SM4500-NH3C			
Bacteria	E coli: 1103.1; 1603 Enterococcus: 1106.1; 1600			
Boron	EPA 212.3			
Chloride	EPA 9251			
Color	EPA 110.2			
Specific Conductance	SM 2510B			
Detergents & Surfactants	EPA 425.1/SM5540C			
Fluoride	EPA 300.0			
Hardness	EPA 130.1/SM 2340B			
Optical Enhancers	N/A*			
pH	EPA 150.1/SM 4500H			
Potassium	EPA 200.7			
Turbidity	SM 2130B			

*- There is presently no USEPA Standard Method for analysis of optical enhancers. Typically, sample pads are described as with “Present” or “Not Present” for fluorescing dye when exposed to UV light or a fluorometer.

Appendix D: IDDE Employee Training Records

DPW Staff IDDE/Good Housekeeping Training

Friday, August 17, 2018

Present:
Alexander, D.
Balfe, P.
Binda, A.
Brown, R.
Carroll, B.
Colligan, C.
Dunphy, T.
Evans, D.
Febo, G.
Larkin, K.
Leonard, R.
McCarthy, B.
McGrath, C.
Peterson, S.
Rizzi, P.
Rota, A.
Ortega, F.
DeMello, M.

Agenda:

- Introduction
  - Quick brief - what is stormwater?
    - Rain, snow, snowmelt, and runoff that runs into the storm sewer.
    - Usually picks up pollutants on the ground on its way to waterways
    - Largest growing source of water pollution in the northeastern US, in part because it's hard to identify and stop a source.
  - Why are we here?
    - New Clean Water Act permit requires us to hold a training session about stormwater management each year
    - Training is to review and reinforce good management habits such as spill prevention and response
    - We are also going to talk about recognizing illicit discharges so that any staff member can make a report
  - What we are doing today
    - Watching some training videos prepared by the Pioneer Valley Planning Commission and discussing them
    - Talking about what we do now and points where we could improve

        - We are expected to plan and implement all improvements by 2020

- Show: IDDE Module 1 (PVPC DVD)
    - Showing because you all are out and about in town all day - if you see something that you think might be an illicit discharge, let us know and we can take a look.
    - Refer potential IDs and SSOs to Tom and me

- Show: Good Housekeeping Module 2; stop at points for discussion

- Wrap up
    - Good housekeeping is just a lot of good habits that we (mostly) already have
    - These requirements are what EPA/MassDEP expects at minimum, we should aim to be compliant or improve upon these systems
- Next time
    - The Stormwater Pollution Prevention Program (SWPPP) will be the major document governing how the DPW facility is managed
    - After it is drafted, we will talk it through with you to make sure that:
        - You understand what is expected
        - The systems we have set up make sense for your work and are feasible for you

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Post training notes:
DVD player did not work well, consider dry-run to confirm technology works next time
Ensure sign language interpreter is present
Having Tom introduce is helpful