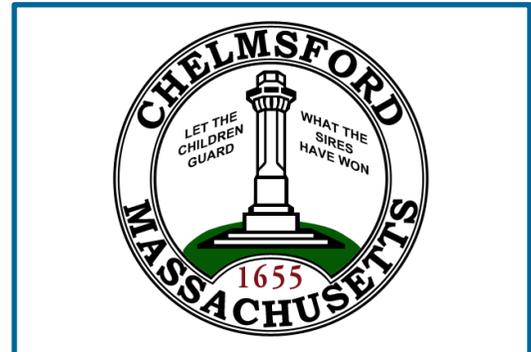
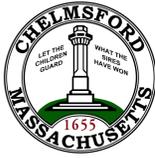


# Illicit Discharge Detection and Elimination (IDDE) Plan

June 1, 2020





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## Illicit Discharge Detection and Elimination Plan

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# 1 Introduction

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## 1.1 MS4 Program

This Illicit Discharge Detection and Elimination (IDDE) Plan has been developed by the Town of Chelmsford 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.

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## 1.2 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.



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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.

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### 1.3 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



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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).

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### 1.4 Receiving Waters and Impairments

**Table 1-1** lists the “impaired waters” within the boundaries of Chelmsford’s regulated area based on the 2016 Massachusetts Integrated List of Waters produced by MassDEP. 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.



**Table 1-1. Impaired Waters  
Chelmsford, Massachusetts**

| Waterbody Segment              | Number of Outfalls | Segment ID | Category (b) | Impairments |               |                  |          |                  |            |                      |         | Other Pollutant(s) Causing Impairments |              |  |
|--------------------------------|--------------------|------------|--------------|-------------|---------------|------------------|----------|------------------|------------|----------------------|---------|--|--------------|--|
|                                |                    |            |              | Chloride    | Chlorophyll-a | Dissolved Oxygen | Nitrogen | Oil & Grease/PAH | Phosphorus | Solids/TSS/Turbidity | E. coli |  | Enterococcus |  |
| Merrimack River                | 2                  | MA84A-01   | 5            |             |               |                  |          |                  |            |                      |         |  |              | Mercury in Fish Tissue;<br>Fecal Coliform  |
| Concord River                  | 2                  | MA82A-08   | 5            |             |               |                  |          |                  | X          |                      |         |  |              | Eurasian Water Milfoil, Myriophyllum spicatum;<br>Non-Native Aquatic Plants;<br>Mercury in Fish Tissue;<br>Fecal Coliform  |
| Elm Street Pond                | 26                 | MA82032    | 3            |             |               |                  |          |                  |            |                      |         |  |              |  |
| Beaver Brook                   | 121                | MA82A-34   | 5            |             |               |                  |          |                  |            |                      |         | X                                      |              |  |
| Heart Pond                     | 10                 | MA82059    | 5            |             |               |                  |          |                  |            |                      |         | X                                      |              |  |
| River Meadow Brook             | 63                 | MA82A-10   | 5            |             |               |                  |          |                  |            |                      |         | X                                      |              | Debris/Floatables/Trash;<br>Non-Native Aquatic Plants;<br>Fecal Coliform   |
| Black Brook                    | 58                 | MA84A-17   | 5            |             |               |                  |          |                  |            | X                    |         | X                                      |              | Debris/Floatables/Trash;<br>Physical substrate habitat alterations;<br>Aquatic Macroinvertebrate alterations;<br>Fishes Bioassessments;<br>Sedimentation/Siltation |
| Deep Brook                     | 14                 | MA84A-21   | 5            |             |               |                  |          |                  |            |                      |         | X                                      |              | Habitat Assessment Streams;<br>Aquatic Macroinvertebrate Bioassessments;<br>Fishes Bioassessments;<br>Sedimentation/Siltation                                      |
| Freeman Lake/<br>Newfield Pond | 22                 | MA84046    | 5            |             |               | X                |          |                  |            |                      |         |  |              | Eurasian Water Milfoil, Myriophyllum spicatum;<br>Non-Native Aquatic Plants;<br>Mercury in Fish Tissue   |
| Stony Brook                    | 33                 | MA84B-04   | 5            |             |               |                  |          |                  |            |                      |         | X                                      |              | Aquatic Macroinvertebrate Bioassessments   |
| Putnam Brook                   | 27                 |            |              |             |               |                  |          |                  |            |                      |         |  |              |  |
| Farley Brook                   | 36                 |            |              |             |               |                  |          |                  |            |                      |         |  |              |  |
| Hales Brook                    | 57                 |            |              |             |               |                  |          |                  |            |                      |         |  |              |  |
| Crooked Spring Brook           | 35                 |            |              |             |               |                  |          |                  |            |                      |         |  |              |  |
| Russell Mill Pond              | 46                 |            |              |             |               |                  |          |                  |            |                      |         |  |              |  |
| Swain Pond                     | 1                  |            |              |             |               |                  |          |                  |            |                      |         |  |              |  |
| Cold Spring Brook              | 3                  |            |              |             |               |                  |          |                  |            |                      |         |  |              |  |
| Golden Cove Brook              | 10                 |            |              |             |               |                  |          |                  |            |                      |         |  |              |  |
| Unnamed Wetland Lowell         | 1                  |            |              |             |               |                  |          |                  |            |                      |         |  |              |  |
| Westford-Gilson Brook          | 6                  |            |              |             |               |                  |          |                  |            |                      |         |  |              |  |



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| Waterbody Segment                | Number of Outfalls | Segment ID | Category (b) | Impairments |               |                  |          |                  |            |                      |         |              | Other Pollutant(s) Causing Impairments |
|----------------------------------|--------------------|------------|--------------|-------------|---------------|------------------|----------|------------------|------------|----------------------|---------|--------------|--|
|                                  |                    |            |              | Chloride    | Chlorophyll-a | Dissolved Oxygen | Nitrogen | Oil & Grease/PAH | Phosphorus | Solids/TSS/Turbidity | E. coli | Enterococcus |  |
| Scotty Hollow Brook              | 3                  |            |              |             |               |                  |          |                  |            |                      |         |              |  |
| Ditch North of Rt. 495           | 11                 |            |              |             |               |                  |          |                  |            |                      |         |              |  |
| Ditch South of Rt. 495           | 10                 |            |              |             |               |                  |          |                  |            |                      |         |              |  |
| Low Point near Bridge Street     | 6                  |            |              |             |               |                  |          |                  |            |                      |         |              |  |
| Lowell Middlesex Canal           | 5                  |            |              |             |               |                  |          |                  |            |                      |         |              |  |
| Isolated                         | 12                 |            |              |             |               |                  |          |                  |            |                      |         |              |  |
| Private Wetland near Lowell      | 1                  |            |              |             |               |                  |          |                  |            |                      |         |              |  |
| Retention Basin                  | 1                  |            |              |             |               |                  |          |                  |            |                      |         |              |  |
| Wetland at Driftwood             | 1                  |            |              |             |               |                  |          |                  |            |                      |         |              |  |
| Wetland behind Cross Road        | 1                  |            |              |             |               |                  |          |                  |            |                      |         |              |  |
| Wetland behind Farley Brook Road | 1                  |            |              |             |               |                  |          |                  |            |                      |         |              |  |
| Wetland behind Walmart           | 2                  |            |              |             |               |                  |          |                  |            |                      |         |              |  |
| Wetland Downing                  | 2                  |            |              |             |               |                  |          |                  |            |                      |         |              |  |
| Wetland Lantern                  | 1                  |            |              |             |               |                  |          |                  |            |                      |         |              |  |
| Wetland South of Rt. 495         | 1                  |            |              |             |               |                  |          |                  |            |                      |         |              |  |
| Wetland Tanglewood               | 1                  |            |              |             |               |                  |          |                  |            |                      |         |              |  |

- a) Acronyms: PAH = polycyclic aromatic hydrocarbon; Rt. = Route; TMDL = Total Maximum Daily Load; TSS = total suspended solids
- b) Category 3 Waters - water bodies for which insufficient or no information is available to assess any of their designated uses  
 Category 4C Waters - impaired water bodies where the impairment is not caused by a pollutant. No TMDL required  
 Category 5 Waters - impaired water bodies that require a TMDL



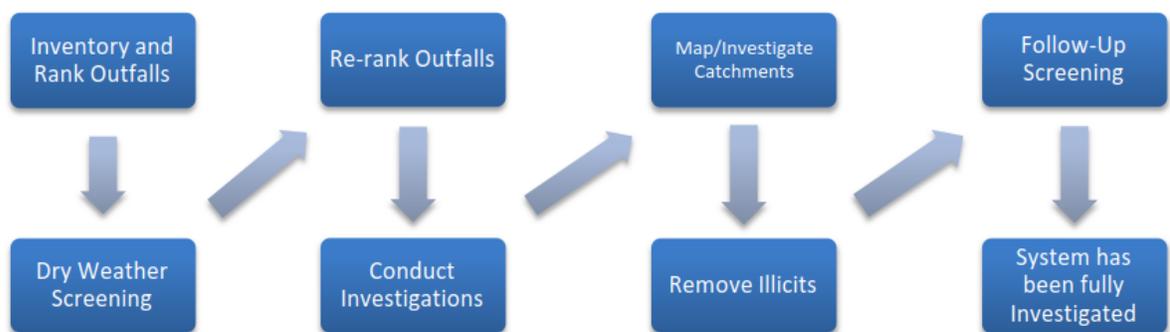
## 1.5 IDDE Program Goals, Framework, and Timeline

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
- Follow-up screening
- Employee training.

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**





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**Table 1-2. 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        |



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## 1.6 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 Chelmsford 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
- Developed procedures for locating illicit discharges (i.e., visual screening of outfalls for dry weather discharges, dye or smoke testing)
- 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 have been completed include:

- Sanitary sewer overflows (SSO) inventory
- Initial outfall sampling
- Additional storm system mapping, including the locations of catch basins, manholes, pipe connectivity, detention basins, treatment structures, and culverts



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## 2 Authority and Statement of IDDE Responsibilities

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### 2.1 Legal Authority

The Town of Chelmsford has adopted Bylaw Chapter 142-6 Discharge of Water to Public Ways or Sidewalks; Discharges to Storm Sewer System (Revised 04-26-2010). A copy of the Bylaw Chapter 142-6 Discharge of Water to Public Ways or Sidewalks; Discharges to Storm Sewer System is provided in **Appendix A**. The Bylaw Chapter 142-6 Discharge of Water to Public Ways or Sidewalks; Discharges to Storm Sewer System provides the Town of Chelmsford 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.

The Town of Chelmsford will review its current Bylaw Chapter 142-6 Discharge of Water to Public Ways or Sidewalks; Discharges to Storm Sewer System and related land use regulations and policies for consistency with the 2016 MS4 Permit.

### 2.2 Statement of Responsibilities

The Chelmsford Department of Public Works (DPW) is the lead municipal agency or department responsible for implementing the IDDE program pursuant to the provisions of the Bylaw Chapter 142-6 Discharge of Water to Public Ways or Sidewalks; Discharges to Storm Sewer System. Other agencies or departments with responsibility for aspects of the program are listed on pages 4 through 6 of the Stormwater Management Plan (SWMP). The most recent version of the SWMP is provided on the Town's website <https://www.townofchelmsford.us/DocumentCenter/View/10077/Chelmsford-SWMP-2019>.



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## 3 Stormwater System Mapping

The Town of Chelmsford 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 on the Town's GIS website <https://chelmsfordma.mapgeo.io> and is updated annually. 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 Chelmsford DPW is responsible for updating the stormwater system mapping pursuant to the 2016 MS4 Permit. The Town of Chelmsford will report on the progress towards completion of the storm system map in each annual report. Updates to the stormwater mapping will be included on the Town's website.

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### 3.1 Phase I Mapping

Phase I mapping has been completed, and includes 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.

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### 3.2 Phase II Mapping

Phase II mapping must be completed within ten (10) years of the effective date of the permit (July 1, 2028) 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.



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- Municipal Sanitary Sewer system

The Town of Chelmsford has completed the following updates to its stormwater mapping to meet the Phase II requirements:

- Outfall spatial location (latitude and longitude with a minimum accuracy of +/-30 feet) (updated: June 2019)
- Pipes (updated: June 2019)
- Manholes (updated: June 2019)
- Catch basins (updated: June 2019)
- Municipal Sanitary Sewer system (updated: June 2019)

The Town of Chelmsford will update its stormwater mapping by July 1, 2028 to include the remaining following Phase II information.



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### 3.3 Additional Recommended Mapping Elements

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

- Storm sewer material and size (pipe diameter)
- Sanitary sewer system material, size (pipe diameter), and age
- Privately owned stormwater treatment structures
- Topography
- Orthophotography
- Locations of suspected confirmed and corrected illicit discharges with dates and flow estimates.



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## 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 of Chelmsford 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 of Chelmsford 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 of Chelmsford 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 Chelmsford DPW 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.





## 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.

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### 5.1 Outfall Catchment Delineations

A catchment is the area that drains to an individual outfall<sup>1</sup> or interconnection.<sup>2</sup> 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.

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### 5.2 Outfall and Interconnection Inventory and Initial Ranking

The Chelmsford DPW has completed an initial outfall and interconnection inventory and priority ranking to assess illicit discharge potential based on existing information. The initial inventory and ranking was 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 are classified into one of the following categories:

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<sup>1</sup> **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.

<sup>2</sup> **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.



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**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  $\geq 0.5$  mg/L, surfactants  $\geq 0.25$  mg/L, and bacteria levels greater than the water quality criteria applicable to the receiving water, or
- Ammonia  $\geq 0.5$  mg/L, surfactants  $\geq 0.25$  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 are 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.**



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- **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.
- **Sewer conversion** – Contributing catchment areas that were once serviced by septic systems, but have been converted to sewer connections may have a high 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.
- **Dry Weather Flow** – Water flow observed during dry weather inspection/sampling events.

**Table 5-1** provides a sample format for the outfall inventory and priority ranking. The Town of Chelmsford's outfall inventory and priority ranking is provided in **Appendix B**.



**Table 5-1. Outfall Inventory and Priority Ranking Matrix – Sample Format**

**Chelmsford, Massachusetts**  
**Revision Date: June 30, 2020**

| Outfall ID         | Receiving Water | Previous Screening Results Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup> | Density of Generating Sites <sup>4</sup> | Age of Development/ Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
|--------------------|-----------------|--|---|--|--------------------------------------|--|---|--|----------------------------|---------------------------------|-------------------------------|-------|------------------|
| Information Source |                 | Outfall inspections and sample results                               | GIS Maps  | Town Staff                                 | Impaired Waters List                 | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation        | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
| Scoring Criteria   |                 | Yes = 3 (Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Poor = 3<br>Fair = 2<br>Good = 0     | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1               | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| Sample 1           | XYZ River       | 3  | 0   | 2  | 0                                    | 2  | 1   | 0  | 0                          | 3                               | 0                             | 13    | Problem          |
| Sample 2           | XYZ Lake        | 0  | 3   | 0  | 3                                    | 1  | 2   | 0  | 3                          | 3                               | 2                             | 17    | High Priority    |
| Sample 3           | XYZ Stream      | 0  | 0   | 2  | 0                                    | 1  | 1   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
|                    |                 |  |   |  |                                      |  |   |  |                            |                                 |                               |       |                  |
|                    |                 |  |   |  |                                      |  |   |  |                            |                                 |                               |       |                  |

**Scoring Criteria:**

<sup>1</sup> Previous screening results indicate likely sewer input if any of the following are true:

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

<sup>2</sup> Outfalls/interconnections that discharge to or in the vicinity of any of the following areas: public beaches, recreational areas, drinking water supplies, or shellfish beds

<sup>3</sup> Receiving water quality based on latest version of MassDEP Integrated List of Waters.

- Poor = Waters with approved TMDLs (Category 4a Waters) where illicit discharges have the potential to contain the pollutant identified as the cause of the impairment
- Fair = Water quality limited waterbodies that receive a discharge from the MS4 (Category 5 Waters)
- Good = No water quality impairments

<sup>4</sup> Generating sites are institutional, municipal, commercial, or industrial sites with a potential to contribute to illicit discharges (e.g., car dealers, car washes, gas stations, garden centers, industrial manufacturing, etc.)

<sup>5</sup> Age of development and infrastructure:

- High = Industrial areas greater than 40 years old and areas where the sanitary sewer system is more than 40 years old
- Medium = Developments 20-40 years old
- Low = Developments less than 20 years old

<sup>6</sup> Areas once served by combined sewers and but have been separated, or areas once served by septic systems but have been converted to sanitary sewers.

<sup>7</sup> Aging septic systems are septic systems 30 years or older in residential areas.

<sup>8</sup> Any river or stream that is culverted for distance greater than a simple roadway crossing.

<sup>9</sup> Outfalls/interconnections with water flow observed during dry weather inspection/sampling events.



## 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 Chelmsford DPW is responsible for conducting dry weather outfall screening, starting with High Priority outfalls, followed by Low Priority outfalls, based on the initial priority rankings described in the previous section.

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### 6.1 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 a weather station connected to the Weather Underground Website. The name of the weather station is **Subway Ave Station, ID: KMACHELM19**, Elev 154 ft, 42.62 °N, 71.34 °W. Data for the station can be accessed at the following link:

<https://www.wunderground.com/weather/us/ma/chelmsford/KMACHELM19>.

If the Weather Underground Subway Ave Station data is not available, then staff will use Weather Station **McIntosh Station, ID: KMACHELM9**, Elev 243 ft, 42.59 °N, 71.39 °W. Data for the station can be accessed at the following link:

<https://www.wunderground.com/weather/us/ma/chelmsford/KMACHELM9>.

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### 6.2 Dry Weather Screening/Sampling Procedure

The dry weather screening and sampling procedures described in this section are based on the requirements outlined in the 2016 MS4 Permit. The relevant standard operating procedure (SOP) documents are provided in **Appendix C**.

#### 6.2.1 General Procedure

The dry weather outfall inspection and sampling procedure consists 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



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- b. Record the inspection information and outfall characteristics (using paper forms or 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.

Previous outfall screening/sampling conducted under the 2013 MS4 Permit may be used to satisfy the dry weather outfall/screening requirements of the 2016 MS4 Permit only if the previous screening and sampling was substantially equivalent to that required by the 2016 MS4 Permit, including the list of analytes outlined in Section 2.3.4.7.b.iii.4 of the 2016 permit.

### 6.2.2 Field Equipment

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



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

| <b>Equipment</b>                    | <b>Use/Notes</b>   |
|-------------------------------------|--|
| Clipboard                           | For organization of field sheets and writing surface   |
| Field Sheets                        | Field sheets for both dry weather inspection and Dry weather sampling should be available with extras  |
| Chain of Custody Forms              | To ensure proper handling of all samples   |
| Pens/Pencils/Permanent Markers      | For proper labeling  |
| 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                     | For transporting samples to the laboratory   |
| Digital Camera                      | For documenting field conditions at time of inspection   |
| Personal Protective Equipment (PPE) | Reflective vest, Safety glasses and boots at a minimum   |
| GPS Receiver                        | For taking spatial location data   |
| Water Quality Sonde                 | If needed, for sampling conductivity, temperature, pH  |
| Water Quality Meter                 | Hand held meter, if available, for testing for various water quality parameters such as ammonia, surfactants and chlorine  |
| Test Kits                           | Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day  |
| Label Tape                          | For labeling sample containers   |
| Sample Containers                   | Make sure all sample containers are clean.<br>Keep extra sample containers on hand at all times.<br>Make sure there are proper sample containers for what is being sampled for (i.e., bacteria requires sterile containers). |
| Spray Bottle of Alcohol             | Cleaning sample containers after each use  |
| Pry Bar or Pick                     | For opening catch basins and manholes when necessary   |
| Distilled Water                     | Cleaning sample containers after each use  |
| Bug Spray                           | Repelling insects  |
| Branch loppers                      | Trimming branches that obstruct outfall access   |
| Sandbags                            | For damming low flows in order to take samples   |
| Small Mallet or Hammer              | Helping to free stuck manhole and catch basin covers   |
| Utility Knife                       | Multiple uses  |
| Measuring Tape                      | Measuring distances and depth of flow  |
| Safety Cones                        | Safety   |
| Hand Sanitizer                      | Disinfectant/decontaminant   |
| Zip Ties/Duct Tape                  | For making field repairs   |
| Rubber Boots/Waders                 | For accessing shallow streams/areas  |
| Sampling Pole/Dipper/Sampling Cage  | For accessing hard to reach outfalls and manholes  |



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### 6.2.3 Sample Collection and Analysis

If flow is present during a dry weather outfall inspection, a sample will be collected and analyzed for the required permit parameters<sup>3</sup> listed in **Table 6-2**. The general procedure for collection of outfall samples is as follows:

1. Fill out all sample information on sample bottles and field sheets (see **Appendix C** for Sample Labels and Field Sheets)
2. Put on protective gloves (nitrile/latex/other) before sampling
3. Collect sample with dipper or directly in sample containers. If possible, collect water from the flow directly in the sample bottle. Be careful not to disturb sediments.
4. If using a dipper or other device, triple rinse the device with distilled water and then in water to be sampled (not for bacteria sampling)
5. Use test strips, test kits, and field meters (rinse similar to dipper) for most parameters (see **Table 6-2**)
6. Place laboratory samples on ice for analysis of bacteria and pollutants of concern
7. Fill out chain-of-custody form (**Appendix C**) for laboratory samples
8. Deliver samples to Nashoba Analytical
9. Dispose of used test strips and test kit ampules properly
10. 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**.

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<sup>3</sup> Other potentially useful parameters, although not required by the MS4 Permit, include **fluoride** (indicator of potable water sources in areas where water supplies are fluoridated), **potassium** (high levels may indicate the presence of sanitary wastewater), and **optical brighteners** (indicative of laundry detergents).



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**Table 6-2. Sampling Parameters and Analysis Methods**

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

<sup>1</sup> Where the discharge is directly into a water quality limited water or a water subject to an approved TMDL, the sample must be analyzed for the pollutant(s) of concern identified as the cause of the water quality impairment.

Testing for indicator bacteria and any pollutants of concern must be conducted using analytical methods and procedures found in 40 CFR § 136.<sup>4</sup> Outfalls discharging to waterbodies with Fecal Coliform impairments will test for *E. coli* as the indicator bacteria per Section 2.3.4.6 of the MS4 Permit. 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.

<sup>4</sup> 40 CFR § 136: <http://www.ecfr.gov/cgi-bin/text-idx?SID=b3b41fdea0b7b0b8cd6c4304d86271b7&mc=true&node=pt40.25.136&rgn=div5>



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**Table 6-3. Required Analytical Methods, Detection Limits, Hold Times, and Preservatives<sup>4</sup>**

| Analyte or Parameter   | Analytical Method   | Detection Limit   | Max. Hold Time            | Preservative  |
|--|---|---|---------------------------|---|
| Ammonia  | <b>EPA:</b> 350.2, <b>SM:</b> 4500-NH3C   | 0.05 mg/L   | 28 days                   | Cool $\leq 6^{\circ}\text{C}$ ,<br>H <sub>2</sub> SO <sub>4</sub> to pH <2,<br>No preservative required if analyzed immediately |
| Surfactants  | <b>SM:</b> 5540-C   | 0.01 mg/L   | 48 hours                  | Cool $\leq 6^{\circ}\text{C}$   |
| Chlorine   | <b>SM:</b> 4500-CI G  | 0.02 mg/L   | Analyze within 15 minutes | None Required   |
| Temperature  | <b>SM:</b> 2550B  | NA  | Immediate                 | None Required   |
| Specific Conductance   | <b>EPA:</b> 120.1, <b>SM:</b> 2510B   | 0.2 $\mu\text{s}/\text{cm}$   | 28 days                   | Cool $\leq 6^{\circ}\text{C}$   |
| Salinity   | <b>SM:</b> 2520   | -   | 28 days                   | Cool $\leq 6^{\circ}\text{C}$   |
| Indicator Bacteria:<br><i>E. coli</i><br>Enterococcus  | <i>E. coli</i><br><b>EPA:</b> 1603<br><b>SM:</b> 9221B, 9221F, 9223 B<br><b>Other:</b> Colilert®, Colilert-18®<br><br><i>Enterococcus</i><br><b>EPA:</b> 1600<br><b>SM:</b> 9230 C<br><b>Other:</b> Enterolert® | <i>E. coli</i><br><b>EPA:</b> 1 cfu/100mL<br><b>SM:</b> 2 MPN/100mL<br><b>Other:</b> 1 MPN/100mL<br><br><i>Enterococcus</i><br><b>EPA:</b> 1 cfu/100mL<br><b>SM:</b> 1 MPN/100mL<br><b>Other:</b> 1 MPN/100mL | 8 hours                   | Cool $\leq 10^{\circ}\text{C}$ ,<br>0.0008%<br>Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>                                    |
| Total Phosphorus   | <b>EPA:</b> Manual-365.3, Automated Ascorbic acid digestion-365.1 Rev. 2, ICP/AES4-200.7 Rev. 4.4<br><br><b>SM:</b> 4500-P E-F  | <b>EPA:</b> 0.01 mg/L<br><b>SM :</b> 0.01 mg/L  | 28 days                   | Cool $\leq 6^{\circ}\text{C}$ ,<br>H <sub>2</sub> SO <sub>4</sub> to pH <2  |
| Total Nitrogen (Ammonia + Nitrate/Nitrite, methods are for Nitrate-Nitrite and need to be combined with Ammonia listed above.) | <b>EPA:</b> Cadmium reduction (automated)-353.2 Rev. 2.0, <b>SM:</b> 4500-NO <sub>3</sub> E-F   | <b>EPA:</b> 0.05 mg/L<br><b>SM :</b> 0.05 mg/L  | 28 days                   | Cool $\leq 6^{\circ}\text{C}$ ,<br>H <sub>2</sub> SO <sub>4</sub> to pH <2  |

SM = Standard Methods



## 6.3 Interpreting Outfall Sampling Results

Outfall analytical data from dry weather sampling can be used to help identify the major type or source of discharge. **Table 6-4** 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.

**Table 6-4. Benchmark Field Measurements for Select Parameters**

| Analyte or Parameter   | Benchmark   |
|--|---|
| Ammonia  | >0.5 mg/L   |
| Conductivity   | >2,000 $\mu$ S/cm   |
| Surfactants  | >0.25 mg/L  |
| Chlorine   | >0.02 mg/L<br>(detectable levels per the 2016 MS4 Permit)   |
| Indicator Bacteria <sup>5</sup> :<br><i>E. coli</i><br><i>Enterococcus</i> | <i>E. coli</i> : the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 126 colonies per 100 ml and no single sample taken during the bathing season shall exceed 235 colonies per 100 ml<br><br><i>Enterococcus</i> : the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 33 colonies per 100 ml and no single sample taken during the bathing season shall exceed 61 colonies per 100 ml |

## 6.4 Follow-up Ranking of Outfalls and Interconnections

The Town of Chelmsford 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).

<sup>5</sup> Massachusetts Water Quality Standards:  
<http://www.mass.gov/eea/docs/dep/service/regulations/314cmr04.pdf>



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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 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.

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### 7.1 System Vulnerability Factors

The Chelmsford DPW will review relevant mapping and historic plans and records to identify areas within the catchment with higher potential for illicit connections. The following information will be reviewed:

- Plans related to the construction of the drainage network
- Plans related to the construction of the sewer drainage network
- Prior work on storm drains or sewer lines
- Board of Health or other municipal data on septic systems
- Complaint records related to SSOs
- Septic system breakouts.

Based on the review of this information, the presence of any of the following **System Vulnerability Factors (SVFs)** will be identified for each catchment:

- History of SSOs, including, but not limited to, those resulting from wet weather, high water table, or fat/oil/grease blockages
- Crossings of storm and sanitary sewer alignments where the sanitary system is shallower than the storm drain system
- Inadequate sanitary sewer level of service (LOS) resulting in regular surcharging, customer back-ups, or frequent customer complaints



## The Town of Chelmsford

- 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
- 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 (indicative of inadequate soils, water table separation, or other physical constraints of the area rather than poor owner maintenance)
- History of multiple Board of Health actions addressing widespread septic system failures (indicative of inadequate soils, water table separation, or other physical constraints of the area rather than poor owner maintenance).

A SVF inventory will be documented for each catchment (see **Table 7-1** for example format), retained as part of the IDDE Plan, and included in the annual report.



**Table 7-1. Outfall Catchment System Vulnerability Factor (SVF) Inventory – Sample Format**

Chelmsford, Massachusetts  
Revision Date: June 1, 2020

| Outfall ID | Receiving Water | 1<br>History of SSOs | 2<br>Common or Twin Invert Manholes | 3<br>Common Trench Construction | 4<br>Storm/Sanitary Crossings (Sanitary Above) | 5<br>Sanitary Lines with Underdrains | 6<br>Inadequate Sanitary Level of Service | 7<br>Areas Formerly Served by Combined Sewers | 8<br>Sanitary Infrastructure Defects | 9<br>SSO Potential In Event of System Failures | 10<br>Sanitary and Storm Drain Infrastructure >40 years Old | 11<br>Septic with Poor Soils or Water Table Separation | 12<br>History of BOH Actions Addressing Septic Failure |
|------------|-----------------|----------------------|-------------------------------------|---------------------------------|--|--------------------------------------|---|---|--------------------------------------|--|---|--|--|
| Sample 1   | XYZ River       | Yes/No               | Yes/No                              | Yes/No                          | Yes/No   | Yes/No                               | Yes/No                                    | Yes/No  | Yes/No                               | Yes/No   | Yes/No  | Yes/No   | Yes/No   |
|            |                 |                      |                                     |                                 |  |                                      |   |   |                                      |  |   |  |  |
|            |                 |                      |                                     |                                 |  |                                      |   |   |                                      |  |   |  |  |
|            |                 |                      |                                     |                                 |  |                                      |   |   |                                      |  |   |  |  |
|            |                 |                      |                                     |                                 |  |                                      |   |   |                                      |  |   |  |  |
|            |                 |                      |                                     |                                 |  |                                      |   |   |                                      |  |   |  |  |
|            |                 |                      |                                     |                                 |  |                                      |   |   |                                      |  |   |  |  |
|            |                 |                      |                                     |                                 |  |                                      |   |   |                                      |  |   |  |  |

**Presence/Absence Evaluation Criteria:**

- 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 (LOS) resulting in regular surcharging, customer back-ups, 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
- 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 (indicative of inadequate soils, water table separation, or other physical constraints of the area rather than poor owner maintenance)
- History of multiple Board of Health actions addressing widespread septic system failures (indicative of inadequate soils, water table separation, or other physical constraints of the area rather than poor owner maintenance)



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## 7.2 Dry Weather Manhole Inspections

The Town of Chelmsford will implement a dry weather storm drain network investigation that involves systematically and progressively observing, sampling and evaluating key junction manholes in the MS4 to determine the approximate location of suspected illicit discharges or SSOs.

The Chelmsford DPW will be responsible for implementing the dry weather manhole inspection program and making updates as necessary. Infrastructure information will be incorporated into the storm system map, and catchment delineations will be refined based on the field investigation, where necessary. The SVF inventory will also be updated based on information obtained during the field investigations, where necessary.

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):

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



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For most catchments, manhole inspections will proceed from the outfall moving up into the system.

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.

Inspection of key junction manholes will proceed as follows:

1. Manholes will be opened and inspected for visual and olfactory evidence of illicit connections. A sample field inspection form is provided in **Appendix C**.
2. If flow is observed, a sample will be collected and analyzed at a minimum for ammonia, chlorine, and surfactants. Field kits can be used for these analyses. Sampling and analysis will be in accordance with procedures outlined in **Section 6**. Additional indicator sampling may assist in determining potential sources (e.g., bacteria for sanitary flows, conductivity to detect tidal backwater, etc.).
3. Where sampling results or visual or olfactory evidence indicate potential illicit discharges or SSOs, the area draining to the junction manhole will be flagged for further upstream manhole investigation and/or isolation and confirmation of sources.
4. Subsequent key junction manhole inspections will proceed until the location of suspected illicit discharges or SSOs can be isolated to a pipe segment between two manholes.
5. If no evidence of an illicit discharge is found, catchment investigations will be considered complete upon completion of key junction manhole sampling.

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### 7.3 Wet Weather Outfall Sampling

Where a minimum of one (1) System Vulnerability Factor (SVF) is identified based on previous information or the catchment investigation, a wet weather investigation must also be conducted at the associated outfall. The Chelmsford DPW will be responsible for implementing the wet weather outfall sampling program and making updates as necessary.

Outfalls will be inspected and sampled under wet weather conditions, to the extent necessary, to determine whether wet weather-induced high flows in sanitary sewers or high



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groundwater in areas served by septic systems result in discharges of sanitary flow to the MS4.

Wet weather outfall sampling will proceed as follows:

1. At least one wet weather sample will be collected at the outfall for the same parameters required during dry weather screening.
2. Wet weather sampling will occur during or after a storm event of sufficient depth or intensity to produce a stormwater discharge at the outfall. There is no specific rainfall amount that will trigger sampling, although minimum storm event intensities that are likely to trigger sanitary sewer interconnections are preferred. To the extent feasible, sampling should occur during the spring (March through June) when groundwater levels are relatively high.
3. If wet weather outfall sampling indicates a potential illicit discharge, then additional wet weather source sampling will be performed, as warranted, or source isolation and confirmation procedures will be followed as described in **Section 7.4**.
4. If wet weather outfall sampling does not identify evidence of illicit discharges, and no evidence of an illicit discharge is found during dry weather manhole inspections, catchment investigations will be considered complete.

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## 7.4 Source Isolation and Confirmation

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
- IDDE Canines

These methods are described in the sections below. Instructions and Standard Operating Procedures (SOPs) for these and other IDDE methods are provided in **Appendix F**.

Public notification is an important aspect of a detailed source investigation program. Prior to smoke testing, dye testing, or TV inspections, the Chelmsford DPW will notify property



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owners in the affected area. Smoke testing notification will include hanging notifications for single family homes, businesses and building lobbies for multi-family dwellings.

### 7.4.1 Sandbagging

This technique can be particularly useful when attempting to isolate intermittent illicit discharges or those with very little perceptible flow. The technique involves placing sandbags or similar barriers (e.g., caulking, weirs/plates, or other temporary barriers) within outlets to manholes to form a temporary dam that collects any intermittent flows that may occur. Sandbags are typically left in place for 48 hours, and should only be installed when dry weather is forecast. If flow has collected behind the sandbags/barriers after 48 hours, it 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.

### 7.4.2 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 placed in areas where there are suspected illegal connections or cracks/leaks, noting any escape of smoke (indicating an illicit connection or damaged storm drain infrastructure). It is important when using this technique to make proper notifications to area residents and business owners as well as local police and fire departments.

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.

### 7.4.3 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



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

### 7.4.4 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.

### 7.4.5 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 sample collected from outfalls or ambient surface waters. Use of a fluorometer, while more quantitative, is typically more costly and is not as effective at isolating intermittent discharges as other source isolation techniques.

### 7.4.6 IDDE Canines

Dogs specifically trained to smell human related sewage are becoming a cost-effective way to isolate and identify sources of illicit discharges. While not widespread at the moment, the



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use of IDDE canines is growing as is their accuracy. The use of IDDE canines is not recommended as a standalone practice for source identification; rather it is recommended as a tool to supplement other conventional methods, such as dye testing, in order to fully verify sources of illicit discharges.

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### 7.5 Illicit Discharge Removal

When the specific source of an illicit discharge is identified, the Town of Chelmsford 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.

#### 7.5.1 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.



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## 7.6 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 in **Section 6** of 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 in **Section 7.3**. All sampling results will be reported in the annual report.



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## 8 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 E**. The frequency and type of training will be included in the annual report.

## 9 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.



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## Appendix A

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### Legal Authority (IDDE Bylaw or Ordinance)

#### **§ 142-6 Discharge of water to public ways or sidewalks; discharges to storm sewer system.**

[Added 1973 ATM by Art. 54; amended 4-26-2010 ATM by Art. 13]

##### **A.**

No water shall be intentionally discharged onto or into any public ways or sidewalks of the Town so as to cause a dangerous and/or defective condition.

##### **B.**

Discharges to the municipal storm sewer system.

##### **(1)**

Definitions.

##### **AUTHORIZED ENFORCEMENT AGENCY**

The Chelmsford Department of Public Works (DPW), its employees, or agents designated to enforce this bylaw.

##### **BEST MANAGEMENT PRACTICE (BMP)**

An activity, procedure, restraint, or structural improvement that helps to reduce the quantity or improve the quality of stormwater runoff.

##### **CLEAN WATER ACT**

The Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.) as may be amended from time to time.

##### **DISCHARGE OF POLLUTANTS**

The addition, from any source of any pollutant, or combination of pollutants, into the municipal storm sewer system or into the waters of the United States or commonwealth.

##### **GROUNDWATER**



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Water beneath the surface of the ground.

### **ILLICIT CONNECTION**

A surface or subsurface drain or conveyance which allows an illicit discharge into the municipal storm sewer system, including without limitation, sewage, process wastewater, or wash water, and any connections from indoor drains, sinks, or toilets, regardless of whether said connection was previously allowed, permitted, or approved before the effective date of this bylaw.

### **ILLICIT DISCHARGE**

Direct or indirect discharge to the municipal storm sewer system that is not composed entirely of stormwater, except as exempted in Subsection **B(6)**. The term does not include a discharge in compliance with an NPDES Stormwater Discharge Permit or a Surface Water Discharge Permit, or resulting from fire-fighting activities exempted pursuant to Subsection **B(6)(a)** of this bylaw.

### **IMPERVIOUS SURFACE**

Any material or structure on or above the ground that prevents water from infiltrating into the underlying soil. Impervious surface includes without limitation, roads, paved parking lots, sidewalks, and rooftops.

### **MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) or MUNICIPAL STORM DRAIN SYSTEM or MUNICIPAL STORM SEWER SYSTEM**

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

#### **(a)**

Owned or operated by a state, city, town, borough, county, parish, district, association or other public body (created by or pursuant to state law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under state law such as a sewer district, flood control district, or drainage district, or similar entity or an Indian tribe or an authorized tribal organization of a designated and approved management agency under Section 208 of the CWA that discharges to waters of the United States;

#### **(b)**

Designated or used for collecting or conveying stormwater;

#### **(c)**



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Which is not a combined sewer;

**(d)**

Which is not part of a publicly owned treatment works (POTW) as defined at 40 CFR 122.2.

### **NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)**

#### **STORMWATER DISCHARGE PERMIT**

A permit issued by the United States Environmental Protection Agency or jointly with the commonwealth that authorizes the discharge of pollutants to waters of the United States.

#### **NON-STORMWATER DISCHARGE**

Discharge to the municipal storm sewer system not composed entirely of stormwater.

#### **PERSON**

An individual, partnership, association, firm, company, trust, corporation, agency, authority, department or political subdivision of the commonwealth or the federal government, to the extent permitted by law and any officer, employee, or agent of such person.

#### **POLLUTANT**

Any element or property of sewage, agricultural, industrial or commercial waste, runoff, leachate, heated effluent, or other matter whether originating at a point or nonpoint source, that is or may be introduced into any sewage treatment works or waters of the commonwealth. Pollutants shall include without limitation:

**(a)**

Paints, varnishes, and solvents;

**(b)**

Oil and other automotive fluids;

**(c)**

Nonhazardous liquid and solid wastes and yard wastes;

**(d)**

Refuse, rubbish, garbage, litter, or other discarded or abandoned objects, ordinances, accumulations, and floatables;



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**(e)**

Pesticides, herbicides, and fertilizers;

**(f)**

Hazardous materials and wastes, sewage, fecal coliform and pathogens;

**(g)**

Dissolved and particulate metals;

**(h)**

Animal wastes;

**(i)**

Rock, sand, salt, and soils with the exception of winter salting and sanding;

**(j)**

Construction wastes and residues; and

**(k)**

Noxious or offensive matter of any kind.

**PROCESS WASTEWATER**

Water, which during manufacturing or processing, comes into direct contact with or results from the production or use of any material, intermediate product, finished product, or waste product.

**RECHARGE**

The process by which groundwater is replenished by precipitation through the percolation of runoff and surface water through the soil.

**STORMWATER**

Rainfall runoff, snowmelt runoff, and surface water runoff and drainage. Runoff shall mean rainfall or snowmelt water flowing over the ground surface.

**SURFACE WATER DISCHARGE PERMIT**

A permit issued by the Department of Environmental Protection (DEP) pursuant to 314 CMR 3.00 that authorizes the discharge of pollutants to waters of the Commonwealth of Massachusetts.



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### **TOXIC OR HAZARDOUS MATERIAL OR WASTE**

Any material which because of its quantity, concentration, or chemical, corrosive, flammable, reactive, toxic, infectious or radioactive characteristics, either separately or in combination with any substance or substances, constitutes a present or potential threat to human health, safety, welfare, or to the environment. Toxic or hazardous materials include any synthetic organic chemical, petroleum product, heavy metal, radioactive or infectious waste; acid and alkali, and any substance defined as toxic or hazardous under MGL c. 21C and c. 21E, and the regulations at 310 CMR 30.000 and 310 CMR 40.0000.

### **WATERCOURSE**

A natural or man-made channel through which water flows or a stream of water, including a river, brook or underground stream.

### **WATERS OF THE COMMONWEALTH**

All waters within the jurisdiction of the commonwealth, including, without limitations, rivers, streams, lakes, ponds, springs, impoundments, estuaries, wetlands, coastal waters, and groundwater.

### **WASTEWATER**

Any sanitary waste, sludge, or septic tank or cesspool overflow and process wastewater.

#### **(2)**

Applicability. This bylaw shall apply to flows entering the municipal separate storm sewer system.

#### **(3)**

Responsibility for administration. The DPW shall administer, implement and enforce this bylaw. Any powers granted to or duties imposed upon the DPW may be delegated in writing by the DPW to employees or agents of the DPW.

#### **(4)**

Regulations. The DPW may promulgate rules and regulations to effectuate the purposes of this bylaw. Failure by the DPW to promulgate such rules and regulations shall not have the effect of suspending or invalidating this bylaw.

#### **(5)**

Prohibited activities.

##### **(a)**

Illicit discharges. No person shall dump, discharge, cause or allow to be discharged any pollutant or non-stormwater discharge into the municipal separate storm sewer system (MS4), into a stormwater BMP on public or private property, into a watercourse or into the waters of the commonwealth.



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### **(b)**

Illicit connections. No person shall construct, use, allow, maintain or continue any illicit connection to the municipal storm sewer system, regardless of whether the connection was permissible under applicable law, regulation or custom at the time of connection.

### **(c)**

Obstruction of municipal storm sewer system. No person shall obstruct or interfere with the normal flow of stormwater into or out of the municipal storm sewer system without prior written approval from the DPW.

### **(6)**

Exemptions.

#### **(a)**

Discharge or flow resulting from fire-fighting activities.

#### **(b)**

The following nonstormwater discharges or flows are exempt from the prohibition of non-stormwaters provided that the source is not a significant contributor of a pollutant to the municipal storm sewer system.

#### **[1]**

Waterline flushing.

#### **[2]**

Flow from potable water sources.

#### **[3]**

Springs.

#### **[4]**

Natural flow from riparian habitats and wetlands.

#### **[5]**

Diverted stream flow.

#### **[6]**

Rising groundwater.

#### **[7]**

Uncontaminated groundwater infiltration as defined in 40 CFR 35.2005(20), or uncontaminated pumped groundwater.

#### **[8]**

Water from exterior foundation drains, footing drains (not including active groundwater dewatering systems), crawl space pumps, or air-conditioning condensation.

#### **[9]**

Discharge from landscape irrigation or lawn watering.

#### **[10]**



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Water from individual residential car washing.

### **[11]**

Discharge from dechlorinated swimming pool water (less than one ppm chlorine) provided the water is allowed to stand for one week prior to draining and the pool is drained in such a way as not to cause a nuisance or erosion.

### **[12]**

Discharge from street sweeping.

### **[13]**

Dye testing, provided verbal notification is given to the DPW prior to the time of the test.

### **[14]**

Non-stormwater discharge permitted under a NPDES permit or a Surface Water Discharge Permit, waiver, or waste discharge order administered under the authority of the United States Environmental Protection Agency or the Massachusetts Department of Environmental Protection, provided that the discharge is in full compliance with the requirements of the permit, waiver, or order and applicable laws and regulations.

[Amended 10-18-2010 ATM by Art. 20]

### **[15]**

Discharge for which advanced written approval is received from the DPW as necessary to protect public health, safety, and welfare, or the environment.

### **(7)**

Emergency suspension of storm sewer system access. The DPW may suspend municipal storm sewer system access to any person or property without prior written notice when such suspension is necessary to stop an actual or threatened discharge of pollutants that presents imminent risk of harm to public health, safety, or welfare, or the environment. In the event any person fails to comply with an emergency suspension order, the DPW may take all reasonable steps to prevent or minimize harm to the public health, safety, welfare or the environment.

### **(8)**

Notification of spills. Notwithstanding other requirements of local law, as soon as a person responsible for a facility or operation, or responsible for emergency response for a facility or operation, has information of or suspects a release of materials at that facility or operation resulting in, or which may result in discharge of pollutants to the municipal storm sewer system or waters of the commonwealth, the person shall take all necessary steps to ensure containment and cleanup of the release. In the event of a release of nonhazardous materials, the reporting person shall notify the DPW no later than the next business day. The reporting person shall provide to the DPW written confirmation of all telephone, facsimile or in-person notifications within three business days thereafter. If the discharge of prohibited materials is



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from a commercial or industrial facility, the facility owner or operator shall retain on site a written record of the discharge and the actions taken to prevent its recurrence. Such reports shall be retained for at least three years from the date of the spill.

### **(9)**

Enforcement. The DPW, or its authorized agent, shall enforce this bylaw, resultant regulations, orders, violation notices, and enforcement orders, and may pursue all civil and criminal remedies for such violations.

### **(a)**

Civil relief. If a person violates the provisions of this bylaw, regulation, permit, notice, or order issued thereunder, the DPW may seek injunctive relief in a court of competent jurisdiction restraining the person from activities that would create further violations or compelling the person to perform abatement or remediation of the violation.

### **(b)**

Orders.

### **[1]**

The DPW or its authorized agent may issue a written order to enforce the provisions of this bylaw or the regulations hereunder, at the expense of the violator or property owner which may include:

### **[a]**

Elimination of illicit connections or discharges to the MS4;

### **[b]**

Performance of monitoring, analyses, and reporting;

### **[c]**

That unlawful discharges, practices, or operations shall cease and desist; and

### **[d]**

Remediation of contamination in connection therewith.

### **[2]**

If the enforcing agent determines that abatement or remediation of contamination is required, the order shall set forth a deadline by which such abatement or remediation must be completed. Said order shall further advise that should the violator or property owner fail to abate or perform remediation within the specified deadlines, the Town of Chelmsford may, at its option, undertake such work, and expenses thereof shall be charged to the violator.

### **[3]**

Within 30 days after completing all measures necessary to abate the violation or to perform remediation, the violator and the property owner will be notified of the costs incurred by the Town of Chelmsford, including administrative costs. The violator or property owner may file a written protest objecting to the amount or basis of costs with the DPW within 30 days of



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receipt of the notification of the costs incurred. If the amount due is not received by the expiration of the time in which to file a protest or within 30 days following a decision of the DPW affirming or reducing the costs, or from a final decision of a court of competent jurisdiction, the costs shall become a special assessment against the property owner and shall constitute a lien on the owner's property for the amount of said costs. Interest shall begin to accrue on any unpaid costs at the statutory rate provided in MGL c. 59, § 57 after the 31st day at which the costs first become due.

### **(c)**

Criminal penalty. Any person who violates any provision of this bylaw, regulation, order or permit issued hereunder, shall be punished by a fine of not more than \$300 per offense. Each day or part thereof that such violation occurs or continues shall constitute a separate offense.

### **(d)**

Noncriminal disposition. As an alternative to criminal prosecution or civil action, the Town of Chelmsford may elect to utilize the noncriminal disposition procedure set forth in MGL c. 40, § 21D, in which case the DPW or authorized agent of the Town shall be the enforcing person. The penalty for the first violation shall be a written warning and/or a fine of \$100. The penalty for the second violation shall be a fine of \$200. The penalty for the third and subsequent violations shall be a fine of \$300. Each day or part thereof that such violation occurs or continues shall constitute a separate offense.

### **(e)**

Entry to perform duties under this bylaw. To the extent permitted by state law, or if authorized by the owner or other party in control of the property, the DPW, its agents, officers, and employees may enter upon privately owned property for the purpose of performing their duties under this bylaw and regulations and may make or cause to be made such examinations, surveys or sampling as the DPW deems reasonably necessary.

### **(f)**

Appeals. The decisions or orders of the DPW shall be final. Further relief shall be to a court of competent jurisdiction.

### **(g)**

Remedies not exclusive. The remedies listed in this bylaw are not exclusive of any other remedies available under any applicable federal, state or local law.

### **(10)**

Transitional provisions. Residential property owners shall have 180 days from the effective date of this bylaw to comply with its provisions.



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## Appendix B

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### Outfall Inventory and Priority Ranking

**Appendix B  
Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
Revision Date: June 2020**

| Outfall ID | Receiving Water           | Previous Screening Results<br>Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup>             | Density of Generating Sites <sup>4</sup> | Age of Development/Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
|------------|---------------------------|---|---|--|--|--|--|--|----------------------------|---------------------------------|-------------------------------|-------|------------------|
|            |                           | Information Source  | GIS Maps  | Town Staff                                 | Impaired Waters List                             | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation       | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
|            |                           | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1              | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D0001      | Deep Brook                | 0   | 0   | 0  | 4  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0003      | Deep Brook                | 0   | 0   | 0  | 4  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0005      | Deep Brook                | 0   | 0   | 0  | 4  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0007      | Deep Brook                | 0   | 0   | 0  | 4  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0009      | Deep Brook                | 0   | 0   | 0  | 4  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0011      | Merrimack River           | 0   | 0   | 0  | 4  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0017      | Wetland behind Cross Road | 0   | 0   | 0  | 0  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0025      | Deep Brook                | 3   | 0   | 0  | 4  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 8     | Problem          |
| D0027      | Deep Brook                | 0   | 0   | 0  | 4  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0029      | Deep Brook                | 0   | 0   | 0  | 4  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0031      | Swain Pond                | 0   | 0   | 0  | 0  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0033      | Deep Brook                | 0   | 0   | 0  | 4  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0035      | Deep Brook                | 0   | 0   | 0  | 4  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0037      | Deep Brook                | 0   | 0   | 0  | 4  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0039      | Deep Brook                | 0   | 0   | 0  | 4  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0043      | Deep Brook                | 0   | 0   | 0  | 4  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0045      | Deep Brook                | 0   | 0   | 0  | 4  | 0  | 2  | 0  | 0                          | 3                               | 0                             | 9     | High Priority    |
| D0059      | Freeman Lake              | 0   | 0   | 0  | 2  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0061      | Freeman Lake              | 0   | 0   | 0  | 2  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0062      | Freeman Lake              | 0   | 0   | 0  | 2  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0063      | Freeman Lake              | 0   | 0   | 0  | 2  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0064      | Freeman Lake              | 0   | 0   | 0  | 2  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0065      | Freeman Lake              | 0   | 3   | 0  | 2  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 7     | High Priority    |
| D0067      | Stony Brook               | 0   | 0   | 0  | 2  | 2  | 2  | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0069      | Stony Brook               | 0   | 0   | 0  | 2  | 2  | 2  | 0  | 0                          | 3                               | 0                             | 9     | High Priority    |
| D0077      | Merrimack River           | 0   | 0   | 0  | 4  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0078      | Scotty Hollow Brook       | 0   | 0   | 0  | 0  | 2  | 2  | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0080      | Scotty Hollow Brook       | 3   | 0   | 0  | 0  | 2  | 2  | 0  | 0                          | 0                               | 0                             | 7     | Problem          |
| D0081      | Scotty Hollow Brook       | 0   | 0   | 0  | 0  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |

**Appendix B  
Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
Revision Date: June 2020**

| Outfall ID | Receiving Water             | Previous Screening Results<br>Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup>             | Density of Generating Sites <sup>4</sup> | Age of Development/ Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
|------------|-----------------------------|---|---|--|--|--|---|--|----------------------------|---------------------------------|-------------------------------|-------|------------------|
|            |                             | Information Source  | GIS Maps  | Town Staff                                 | Impaired Waters List                             | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation        | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
|            |                             | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1               | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D0083      | Freeman Lake                | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0096      | Private Wetland near Lowell | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0097      | Westford Gilson Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0099      | Westford Gilson Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0101      | Westford Gilson Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0103      | Freeman Lake                | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 6     | High Priority    |
| D0105      | Freeman Lake                | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0107      | Freeman Lake                | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0109      | Freeman Lake                | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0111      | Freeman Lake                | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0113      | Freeman Lake                | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 6     | High Priority    |
| D0115      | Freeman Lake                | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0117      | Freeman Lake                | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0119      | Freeman Lake                | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0121      | Cold Spring Brook           | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0126      | Cold Spring Brook           | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0129      | Unnamed Wetlands in Lowell  | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0131      | Freeman Lake                | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0133      | Freeman Lake                | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0135      | Freeman Lake                | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0137      | Westford Gilson Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0139      | Westford Gilson Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0141      | Stony Brook                 | 0   | 0   | 0  | 2  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 5     | High Priority    |
| D0143      | Stony Brook                 | 0   | 0   | 0  | 2  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 3     | Low Priority     |
| D0145      | Freeman Lake                | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0147      | Freeman Lake                | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0149      | Freeman Lake                | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0151      | Stony Brook                 | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0153      | Stony Brook                 | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |

**Appendix B  
Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
Revision Date: June 2020**

| Outfall ID | Receiving Water        | Previous Screening Results<br>Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup>             | Density of Generating Sites <sup>4</sup> | Age of Development/ Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
|------------|------------------------|---|---|--|--|--|---|--|----------------------------|---------------------------------|-------------------------------|-------|------------------|
|            |                        | Information Source  | GIS Maps  | Town Staff                                 | Impaired Waters List                             | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation        | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
|            |                        | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1               | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D0155      | Stony Brook            | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0157      | Stony Brook            | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0159      | Stony Brook            | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0161      | Stony Brook            | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 6     | High Priority    |
| D0163      | Stony Brook            | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0165      | Stony Brook            | 3   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 9     | Problem          |
| D0169      | Stony Brook            | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0170      | Stony Brook            | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0173      | Cold Spring Brook      | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0175      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 3                               | 0                             | 9     | High Priority    |
| D0177      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 3                               | 2                             | 11    | High Priority    |
| D0179      | Wetland behind Walmart | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0181      | Wetland behind Walmart | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0182      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0183      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0185      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0187      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0189      | Westford Gilson Brook  | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0191      | Stony Brook            | 0   | 0   | 0  | 2  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 3     | Low Priority     |
| D0193      | Stony Brook            | 0   | 0   | 0  | 2  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 3     | Low Priority     |
| D0195      | Stony Brook            | 0   | 0   | 0  | 2  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 3     | Low Priority     |
| D0197      | Stony Brook            | 0   | 0   | 0  | 2  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 3     | Low Priority     |
| D0199      | Crooked Spring Brook   | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0201      | Crooked Spring Brook   | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0203      | Crooked Spring Brook   | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0205      | Crooked Spring Brook   | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0207      | Crooked Spring Brook   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0209      | Crooked Spring Brook   | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0213      | Crooked Spring Brook   | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |

**Appendix B  
Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
Revision Date: June 2020**

| Outfall ID | Receiving Water | Previous Screening Results<br>Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup>             | Density of Generating Sites <sup>4</sup> | Age of Development/ Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
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|            |                 | Information Source  | GIS Maps  | Town Staff                                 | Impaired Waters List                             | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation        | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
|            |                 | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1               | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D0215      | Stony Brook     | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0217      | Stony Brook     | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0218      | Stony Brook     | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0219      | Stony Brook     | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0220      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0221      | Stony Brook     | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0223      | Stony Brook     | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0224      | Stony Brook     | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 6     | High Priority    |
| D0225      | Stony Brook     | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 6     | High Priority    |
| D0226      | Stony Brook     | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 6     | High Priority    |
| D0227      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0229      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0231      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0233      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0235      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0237      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0239      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 7     | High Priority    |
| D0240      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0241      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0243      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0245      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0247      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0249      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0251      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0253      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0255      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0257      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0259      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0261      | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |

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|            |                        | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1               | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D0263      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0265      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0267      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0269      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0271      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0273      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0275      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0277      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0279      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0281      | Lowell-Middlesex Canal | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0283      | Lowell-Middlesex Canal | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0285      | Lowell-Middlesex Canal | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0287      | Lowell-Middlesex Canal | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0289      | Stony Brook            | 0   | 0   | 0  | 2  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 5     | High Priority    |
| D0291      | Stony Brook            | 0   | 0   | 0  | 2  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 5     | High Priority    |
| D0293      | Crooked Spring Brook   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 3     | Low Priority     |
| D0295      | Crooked Spring Brook   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0297      | Crooked Spring Brook   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0299      | Crooked Spring Brook   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 3                               | 0                             | 4     | Low Priority     |
| D0301      | Crooked Spring Brook   | 3   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 3                               | 2                             | 9     | Problem          |
| D0303      | Crooked Spring Brook   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 3                               | 2                             | 6     | High Priority    |
| D0305      | Crooked Spring Brook   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 3                               | 2                             | 6     | High Priority    |
| D0307      | Crooked Spring Brook   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 3                               | 2                             | 6     | High Priority    |
| D0308      | Crooked Spring Brook   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 3     | Low Priority     |
| D0309      | Crooked Spring Brook   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 3                               | 2                             | 6     | High Priority    |
| D0311      | Crooked Spring Brook   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0313      | Crooked Spring Brook   | 3   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 4     | Problem          |
| D0315      | Stony Brook            | 0   | 0   | 0  | 2  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 3     | Low Priority     |
| D0317      | Stony Brook            | 0   | 0   | 0  | 2  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |

**Appendix B  
Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
Revision Date: June 2020**

| Outfall ID | Receiving Water        | Previous Screening Results<br>Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup>             | Density of Generating Sites <sup>4</sup> | Age of Development/ Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
|------------|------------------------|---|---|--|--|--|---|--|----------------------------|---------------------------------|-------------------------------|-------|------------------|
|            |                        | Information Source  | GIS Maps  | Town Staff                                 | Impaired Waters List                             | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation        | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
|            |                        | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1               | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D0319      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0321      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0323      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 7     | High Priority    |
| D0325      | Wetland at Driftwood   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0327      | Ditch North of Rt. 495 | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 4     | Low Priority     |
| D0335      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0337      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0339      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0341      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0342      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0343      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0345      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0347      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0349      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0351      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0353      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0355      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0357      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0359      | Golden Cove            | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0361      | Golden Cove            | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0363      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0365      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0367      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0369      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0371      | Lowell-Middlesex Canal | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0373      | River Meadow Brook     | 0   | 0   | 0  | 4  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 8     | High Priority    |
| D0375      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0377      | River Meadow Brook     | 0   | 0   | 0  | 4  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 8     | High Priority    |
| D0379      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |

**Appendix B  
Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
Revision Date: June 2020**

| Outfall ID | Receiving Water      | Previous Screening Results<br>Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup>             | Density of Generating Sites <sup>4</sup> | Age of Development/Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
|------------|----------------------|---|---|--|--|--|--|--|----------------------------|---------------------------------|-------------------------------|-------|------------------|
|            |                      | Information Source  | GIS Maps  | Town Staff                                 | Impaired Waters List                             | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation       | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
|            |                      | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1              | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D0381      | Hales Brook          | 0   | 0   | 0  | 0  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0383      | Hales Brook          | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0385      | Hales Brook          | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0387      | Hales Brook          | 0   | 0   | 0  | 0  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0388      | Hales Brook          | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0389      | Hales Brook          | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 2                             | 3     | Low Priority     |
| D0391      | Hales Brook          | 0   | 0   | 0  | 0  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0393      | Hales Brook          | 0   | 0   | 0  | 0  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0395      | Hales Brook          | 0   | 0   | 0  | 0  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0397      | Hales Brook          | 0   | 0   | 0  | 0  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0399      | Concord River        | 0   | 0   | 0  | 4  | 0  | 2  | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0401      | Concord River        | 0   | 0   | 0  | 4  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0403      | Hales Brook          | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0405      | Hales Brook          | 0   | 0   | 0  | 0  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0409      | Stony Brook          | 0   | 0   | 0  | 2  | 0  | 1  | 0  | 0                          | 3                               | 0                             | 6     | High Priority    |
| D0411      | Crooked Spring Brook | 3   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 2                             | 6     | Problem          |
| D0413      | Crooked Spring Brook | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0415      | Crooked Spring Brook | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0417      | Crooked Spring Brook | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 2                             | 3     | Low Priority     |
| D0419      | Crooked Spring Brook | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 2                             | 3     | Low Priority     |
| D0421      | Crooked Spring Brook | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0423      | Crooked Spring Brook | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0424      | Crooked Spring Brook | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0425      | Crooked Spring Brook | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0426      | Crooked Spring Brook | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0427      | Crooked Spring Brook | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0429      | Crooked Spring Brook | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 2                             | 3     | Low Priority     |
| D0430      | Crooked Spring Brook | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0431      | Crooked Spring Brook | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |

**Appendix B  
Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
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| Outfall ID | Receiving Water        | Previous Screening Results<br>Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup>             | Density of Generating Sites <sup>4</sup> | Age of Development/ Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
|------------|------------------------|---|---|--|--|--|---|--|----------------------------|---------------------------------|-------------------------------|-------|------------------|
|            |                        | Information Source  | GIS Maps  | Town Staff                                 | Impaired Waters List                             | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation        | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
|            |                        | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1               | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D0433      | Crooked Spring Brook   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0435      | Wetland Tanglewood     | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0436      | Wetland Lantern        | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0437      | Wetland Downing        | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0439      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0441      | Wetland Downing        | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0443      | Ditch North of Rt. 495 | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0445      | Ditch North of Rt. 495 | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0446      | Ditch North of Rt. 495 | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0447      | Ditch North of Rt. 495 | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0449      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0451      | Black Brook            | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0453      | Ditch North of Rt. 495 | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0455      | Ditch North of Rt. 495 | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0457      | Wetland South of 495   | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0458      | Ditch South of Rt. 495 | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0459      | Golden Cove            | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 4     | Low Priority     |
| D0460      | Golden Cove            | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0461      | Golden Cove            | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0462      | Golden Cove            | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0463      | Golden Cove            | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 4     | Low Priority     |
| D0467      | Ditch South of Rt. 495 | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0469      | Golden Cove            | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0471      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0472      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0473      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0475      | River Meadow Brook     | 0   | 0   | 0  | 4  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 8     | High Priority    |
| D0477      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0479      | Golden Cove            | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |

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Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
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| Outfall ID         | Receiving Water    | Previous Screening Results<br>Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup>             | Density of Generating Sites <sup>4</sup> | Age of Development/ Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
|--------------------|--------------------|---|---|--|--|--|---|--|----------------------------|---------------------------------|-------------------------------|-------|------------------|
| Information Source |                    | Outfall inspections and sample results                                  | GIS Maps  | Town Staff                                 | Impaired Waters List                             | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation        | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
| Scoring Criteria   |                    | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1               | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D0481              | Golden Cove        | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0483              | River Meadow Brook | 0   | 0   | 0  | 4  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 8     | High Priority    |
| D0485              | River Meadow Brook | 0   | 0   | 0  | 4  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 8     | High Priority    |
| D0487              | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0489              | Hales Brook        | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0491              | Hales Brook        | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0493              | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 1   | 0  | 0                          | 0                               | 0                             | 3     | Low Priority     |
| D0495              | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 1   | 0  | 0                          | 0                               | 0                             | 3     | Low Priority     |
| D0497              | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 1   | 0  | 0                          | 0                               | 0                             | 3     | Low Priority     |
| D0499              | Hales Brook        | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0501              | Hales Brook        | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0502              | Hales Brook        | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0503              | Hales Brook        | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0505              | Hales Brook        | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0507              | Hales Brook        | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0509              | Hales Brook        | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0511              | Hales Brook        | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0521              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0523              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0525              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 7     | High Priority    |
| D0527              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 7     | High Priority    |
| D0529              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0531              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0533              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 7     | High Priority    |
| D0535              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0537              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 7     | High Priority    |
| D0538              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 7     | High Priority    |
| D0539              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0541              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 7     | High Priority    |

**Appendix B  
Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
Revision Date: June 2020**

| Outfall ID | Receiving Water           | Previous Screening Results<br>Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup>             | Density of Generating Sites <sup>4</sup> | Age of Development/ Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
|------------|---------------------------|---|---|--|--|--|---|--|----------------------------|---------------------------------|-------------------------------|-------|------------------|
|            |                           | Information Source  | GIS Maps  | Town Staff                                 | Impaired Waters List                             | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation        | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
|            |                           | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1               | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D0543      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0545      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 3                               | 2                             | 11    | High Priority    |
| D0549      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 3                               | 2                             | 10    | High Priority    |
| D0551      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0553      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0555      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0557      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0559      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0561      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0563      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0565      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0567      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0571      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0573      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0574      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0575      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0577      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0579      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0581      | Ditch North of Rt. 495    | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0582      | Low Spot by Bridge Street | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0583      | Ditch North of Rt. 495    | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0584      | Low Spot by Bridge Street | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0585      | Ditch North of Rt. 495    | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0586      | Low Spot by Bridge Street | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 3     | Low Priority     |
| D0587      | Low Spot by Bridge Street | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0589      | Low Spot by Bridge Street | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0591      | Ditch South of Rt. 495    | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0593      | Ditch South of Rt. 495    | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0595      | Ditch South of Rt. 495    | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |

**Appendix B  
Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
Revision Date: June 2020**

| Outfall ID | Receiving Water        | Previous Screening Results<br>Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup>             | Density of Generating Sites <sup>4</sup> | Age of Development/ Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
|------------|------------------------|---|---|--|--|--|---|--|----------------------------|---------------------------------|-------------------------------|-------|------------------|
|            |                        | Information Source  | GIS Maps  | Town Staff                                 | Impaired Waters List                             | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation        | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
|            |                        | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1               | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D0596      | Ditch South of Rt. 495 | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0597      | Ditch South of Rt. 495 | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0599      | Ditch South of Rt. 495 | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0601      | Ditch South of Rt. 495 | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0603      | Ditch South of Rt. 495 | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0605      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0607      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0609      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0611      | River Meadow Brook     | 0   | 0   | 0  | 4  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 8     | High Priority    |
| D0613      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0615      | River Meadow Brook     | 0   | 0   | 0  | 4  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 8     | High Priority    |
| D0617      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0619      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0621      | Retention Basin        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0623      | Hales Brook            | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0625      | Hales Brook            | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0627      | Hales Brook            | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0628      | Hales Brook            | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0630      | Hales Brook            | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0631      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0632      | Hales Brook            | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0633      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0635      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0637      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 3                               | 0                             | 8     | High Priority    |
| D0639      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 3                               | 2                             | 10    | High Priority    |
| D0641      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 3                               | 0                             | 8     | High Priority    |
| D0643      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0645      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 3                               | 0                             | 8     | High Priority    |
| D0647      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 3                               | 0                             | 8     | High Priority    |

**Appendix B  
Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
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|            |                           | Information Source  | GIS Maps  | Town Staff                                 | Impaired Waters List                             | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation        | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
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| D0649      | Beaver Brook              | 3   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 8     | Problem          |
| D0651      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0653      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0655      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0657      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0659      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0661      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0662      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0663      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0664      | Beaver Brook              | 3   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 11    | Problem          |
| D0667      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0679      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0681      | Putnam Brook              | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0683      | Low Spot by Bridge Street | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0685      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0687      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0689      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0691      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 3                               | 0                             | 9     | High Priority    |
| D0692      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0693      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0694      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0695      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0696      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0697      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0699      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0701      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0703      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0705      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0707      | Beaver Brook              | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |

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| D0709      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0711      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0713      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0715      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0717      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0719      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0721      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0723      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0725      | River Meadow Brook | 0   | 0   | 0  | 4  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 8     | High Priority    |
| D0727      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0729      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0731      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0733      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0734      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 2                             | 6     | High Priority    |
| D0735      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0736      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0738      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0739      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0741      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 2                             | 6     | High Priority    |
| D0742      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 2                             | 6     | High Priority    |
| D0743      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 2                             | 6     | High Priority    |
| D0745      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0747      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0749      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0751      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 7     | High Priority    |
| D0753      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0755      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 7     | High Priority    |
| D0757      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0759      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |

**Appendix B  
Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
Revision Date: June 2020**

| Outfall ID | Receiving Water        | Previous Screening Results<br>Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup>             | Density of Generating Sites <sup>4</sup> | Age of Development/ Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
|------------|------------------------|---|---|--|--|--|---|--|----------------------------|---------------------------------|-------------------------------|-------|------------------|
|            |                        | Information Source  | GIS Maps  | Town Staff                                 | Impaired Waters List                             | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation        | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
|            |                        | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1               | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D0761      | Ditch North of Rt. 495 | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0763      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0765      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0769      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 7     | High Priority    |
| D0771      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0772      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0773      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0781      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0783      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0785      | Putnam Brook           | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0787      | Beaver Brook           | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 7     | High Priority    |
| D0789      | Putnam Brook           | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0791      | Putnam Brook           | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0793      | Putnam Brook           | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0795      | Putnam Brook           | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0797      | Putnam Brook           | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0799      | Putnam Brook           | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0801      | Putnam Brook           | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0803      | Putnam Brook           | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0804      | Putnam Brook           | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0805      | Putnam Brook           | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0807      | Putnam Brook           | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0809      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0811      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0813      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0815      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0817      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0819      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0821      | River Meadow Brook     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |

**Appendix B  
Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
Revision Date: June 2020**

| Outfall ID | Receiving Water    | Previous Screening Results<br>Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup>             | Density of Generating Sites <sup>4</sup> | Age of Development/ Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
|------------|--------------------|---|---|--|--|--|---|--|----------------------------|---------------------------------|-------------------------------|-------|------------------|
|            |                    | Information Source  | GIS Maps  | Town Staff                                 | Impaired Waters List                             | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation        | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
|            |                    | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1               | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D0822      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0823      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0825      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0830      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0831      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0832      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0835      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 2                             | 6     | High Priority    |
| D0836      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0837      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0838      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0839      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0843      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0845      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0847      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0849      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0851      | Beaver Brook       | 3   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 8     | Problem          |
| D0853      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 7     | High Priority    |
| D0855      | Putnam Brook       | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0857      | Putnam Brook       | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0859      | Putnam Brook       | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0861      | Putnam Brook       | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0863      | Putnam Brook       | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0865      | Putnam Brook       | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0867      | Putnam Brook       | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0869      | Putnam Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0871      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0873      | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0875      | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0877      | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |

**Appendix B  
Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
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| Outfall ID | Receiving Water    | Previous Screening Results<br>Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup>             | Density of Generating Sites <sup>4</sup> | Age of Development/ Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
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|            |                    | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1               | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D0879      | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0880      | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0881      | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0883      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0885      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0887      | Hales Brook        | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0889      | Hales Brook        | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0891      | Hales Brook        | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0892      | Hales Brook        | 0   | 0   | 0  | 0  | 2  | 2   | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D0893      | Hales Brook        | 3   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 7     | Problem          |
| D0895      | Hales Brook        | 3   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 7     | Problem          |
| D0897      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0899      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 7     | High Priority    |
| D0901      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0903      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0905      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0907      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0909      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0911      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0913      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0915      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0917      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0919      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0921      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0923      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0925      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0927      | Beaver Brook       | 0   | 3   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 8     | High Priority    |
| D0929      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D0931      | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |

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|            |                    | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1               | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D0933      | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0935      | Putnam Brook       | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 3     | Low Priority     |
| D0937      | Putnam Brook       | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0939      | Putnam Brook       | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0941      | Putnam Brook       | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0943      | Putnam Brook       | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0945      | Putnam Brook       | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D0947      | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0949      | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 4     | Low Priority     |
| D0951      | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0953      | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 3                               | 0                             | 5     | High Priority    |
| D0955      | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 3                               | 0                             | 5     | High Priority    |
| D0957      | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0959      | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D0961      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0962      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0963      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0965      | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 3                               | 0                             | 5     | High Priority    |
| D0967      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0969      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0971      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0973      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0975      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0977      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 3                               | 0                             | 9     | High Priority    |
| D0979      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0981      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0983      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0985      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0987      | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |

**Appendix B  
Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
Revision Date: June 2020**

| Outfall ID         | Receiving Water    | Previous Screening Results<br>Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup>             | Density of Generating Sites <sup>4</sup> | Age of Development/ Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
|--------------------|--------------------|---|---|--|--|--|---|--|----------------------------|---------------------------------|-------------------------------|-------|------------------|
| Information Source |                    | Outfall inspections and sample results                                  | GIS Maps  | Town Staff                                 | Impaired Waters List                             | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation        | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
| Scoring Criteria   |                    | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1               | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D0989              | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0991              | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |
| D0993              | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0997              | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D0999              | Russell Mill Pond  | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1001              | River Meadow Brook | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D1003              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D1005              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D1007              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D1009              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D1011              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D1013              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D1015              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D1017              | Heart Pond         | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D1019              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D1021              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D1023              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D1024              | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1025              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D1026              | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1027              | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1029              | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1030              | Beaver Brook       | 0   | 0   | 0  | 4  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 5     | High Priority    |
| D1031              | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1033              | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1035              | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 4     | Low Priority     |
| D1037              | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1039              | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1041              | Farley Brook       | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 4     | Low Priority     |

**Appendix B  
Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
Revision Date: June 2020**

| Outfall ID | Receiving Water                | Previous Screening Results<br>Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup>             | Density of Generating Sites <sup>4</sup> | Age of Development/ Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
|------------|--------------------------------|---|---|--|--|--|---|--|----------------------------|---------------------------------|-------------------------------|-------|------------------|
|            |                                | Information Source  | GIS Maps  | Town Staff                                 | Impaired Waters List                             | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation        | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
|            |                                | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1               | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D1043      | Farley Brook                   | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1045      | Wetland behind Farley Brook Rd | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 4     | Low Priority     |
| D1047      | Farley Brook                   | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1049      | Farley Brook                   | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1051      | Russell Mill Pond              | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1053      | Russell Mill Pond              | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1055      | River Meadow Brook             | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D1057      | Russell Mill Pond              | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1059      | Russell Mill Pond              | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1061      | Russell Mill Pond              | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1063      | Russell Mill Pond              | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1065      | Russell Mill Pond              | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1067      | Russell Mill Pond              | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1069      | Russell Mill Pond              | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 3                               | 0                             | 5     | High Priority    |
| D1070      | Russell Mill Pond              | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 3                               | 0                             | 5     | High Priority    |
| D1071      | Russell Mill Pond              | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1073      | Russell Mill Pond              | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1074      | Russell Mill Pond              | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1075      | Russell Mill Pond              | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1076      | Russell Mill Pond              | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1077      | Heart Pond                     | 0   | 3   | 0  | 4  | 0  | 2   | 0  | 0                          | 3                               | 0                             | 12    | High Priority    |
| D1079      | Heart Pond                     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D1080      | Elm Street Pond                | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1081      | Heart Pond                     | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D1082      | Elm Street Pond                | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1083      | Elm Street Pond                | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1084      | Elm Street Pond                | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1085      | Elm Street Pond                | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1087      | Elm Street Pond                | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |

**Appendix B  
Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
Revision Date: June 2020**

| Outfall ID | Receiving Water   | Previous Screening Results<br>Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup>             | Density of Generating Sites <sup>4</sup> | Age of Development/ Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
|------------|-------------------|---|---|--|--|--|---|--|----------------------------|---------------------------------|-------------------------------|-------|------------------|
|            |                   | Information Source  | GIS Maps  | Town Staff                                 | Impaired Waters List                             | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation        | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
|            |                   | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1               | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D1089      | Elm Street Pond   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1091      | Elm Street Pond   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1093      | Elm Street Pond   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1094      | Elm Street Pond   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1095      | Farley Brook      | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1097      | Farley Brook      | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 4     | Low Priority     |
| D1099      | Farley Brook      | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1101      | Farley Brook      | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1103      | Farley Brook      | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1105      | Farley Brook      | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1109      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1111      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1112      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1113      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1115      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1117      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1119      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1120      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1123      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1125      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1127      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1129      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1131      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1133      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1135      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1137      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1139      | Heart Pond        | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D1140      | Heart Pond        | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D1141      | Heart Pond        | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |

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Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
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| Outfall ID | Receiving Water   | Previous Screening Results<br>Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup>             | Density of Generating Sites <sup>4</sup> | Age of Development/ Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
|------------|-------------------|---|---|--|--|--|---|--|----------------------------|---------------------------------|-------------------------------|-------|------------------|
|            |                   | Information Source  | GIS Maps  | Town Staff                                 | Impaired Waters List                             | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation        | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
|            |                   | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1               | Yes = 3<br>No = 0                                | Yes = 3<br>No = 0          | Yes = 3<br>No = 0               | Yes = 2<br>No = 0             |       |                  |
| D1142      | Heart Pond        | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |
| D1143      | Elm Street Pond   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1144      | Elm Street Pond   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1145      | Elm Street Pond   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1146      | Elm Street Pond   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1147      | Elm Street Pond   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1149      | Elm Street Pond   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1151      | Elm Street Pond   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1155      | Elm Street Pond   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1157      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 3                               | 0                             | 4     | Low Priority     |
| D1158      | Elm Street Pond   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1159      | Farley Brook      | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 2                             | 3     | Low Priority     |
| D1160      | Elm Street Pond   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1161      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1163      | Elm Street Pond   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1165      | Elm Street Pond   | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1167      | Farley Brook      | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1168      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1169      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1171      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1173      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1175      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1177      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 2   | 0  | 0                          | 0                               | 0                             | 2     | Low Priority     |
| D1179      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1180      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1181      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1183      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1185      | Russell Mill Pond | 0   | 0   | 0  | 0  | 0  | 1   | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1189      | Heart Pond        | 0   | 0   | 0  | 4  | 0  | 2   | 0  | 0                          | 0                               | 2                             | 8     | High Priority    |

**Appendix B  
Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts  
Revision Date: June 2020**

| Outfall ID         | Receiving Water | Previous Screening Results<br>Indicate Likely Sewer Input? <sup>1</sup> | Discharging to Area of Concern to Public Health? <sup>2</sup> | Frequency of Past Discharge Complaints     | Receiving Water Quality <sup>3</sup>             | Density of Generating Sites <sup>4</sup> | Age of Development/Infrastructure <sup>5</sup> | Historic Combined Sewers or Septic? <sup>6</sup> | Aging Septic? <sup>7</sup> | Culverted Streams? <sup>8</sup> | Dry Weather Flow <sup>9</sup> | Score | Priority Ranking |
|--------------------|-----------------|---|---|--|--|--|--|--|----------------------------|---------------------------------|-------------------------------|-------|------------------|
| Information Source |                 | Outfall inspections and sample results                                  | GIS Maps  | Town Staff                                 | Impaired Waters List                             | Land Use/GIS Maps, Aerial Photography    | Land Use Information, Visual Observation       | Town Staff, GIS Maps                             | Land Use, Town Staff       | GIS and Storm System Maps       | Outfall Inspections           |       |                  |
| Scoring Criteria   |                 | Yes = 3<br>(Problem Outfall)<br>No = 0                                  | Yes = 3<br><br>No = 0   | Frequent = 3<br>Occasional = 2<br>None = 0 | Bacteria = 4<br>Poor = 3<br>Fair = 2<br>Good = 0 | High = 3<br>Medium = 2<br>Low = 1        | High = 3<br>Medium = 2<br>Low = 1              | Yes = 3<br><br>No = 0                            | Yes = 3<br><br>No = 0      | Yes = 3<br><br>No = 0           | Yes = 2<br><br>No = 0         |       |                  |
| D1191              | Elm Street Pond | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1193              | Elm Street Pond | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1195              | Heart Pond      | 0   | 0   | 0  | 4  | 0  | 2  | 0  | 0                          | 3                               | 2                             | 11    | High Priority    |
| D1197              | Elm Street Pond | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1199              | Elm Street Pond | 0   | 0   | 0  | 0  | 0  | 1  | 0  | 0                          | 0                               | 0                             | 1     | Low Priority     |
| D1201              | Stony Brook     | 0   | 0   | 0  | 2  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 4     | Low Priority     |
| D1202              | Black Brook     | 0   | 0   | 0  | 4  | 0  | 2  | 0  | 0                          | 0                               | 0                             | 6     | High Priority    |

**Appendix B**  
**Outfall Inventory and Priority Ranking**

**Chelmsford, Massachusetts**  
**Revision Date: June 2020**

**Scoring Criteria:**

<sup>1</sup> Previous screening results indicate likely sewer input if any of the following are true:

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

<sup>2</sup> Outfalls/interconnections that discharge to or in the vicinity of any of the following areas: public beaches, recreational areas, drinking water supplies, or shellfish beds

<sup>3</sup> Receiving water quality based on latest version of MassDEP Integrated List of Waters.

- Bacteria = Waters impaired with bacteria
- Poor = Waters with approved TMDLs (Category 4a Waters) where illicit discharges have the potential to contain the pollutant identified as the cause of the impairment
- Fair = Water quality limited waterbodies that receive a discharge from the MS4 (Category 5 Waters)
- Good = No water quality impairments

<sup>4</sup> Generating sites are institutional, municipal, commercial, or industrial sites with a potential to contribute to illicit discharges (e.g., car dealers, car washes, gas stations, garden centers, industrial manufacturing, etc.)

<sup>5</sup> Age of development and infrastructure:

- High = Industrial areas greater than 40 years old and areas where the sanitary sewer system is more than 40 years old
- Medium = Developments 20-40 years old
- Low = Developments less than 20 years old

<sup>6</sup> Areas once served by combined sewers and but have been separated, or areas once served by septic systems but have been converted to sanitary sewers.

<sup>7</sup> Aging septic systems are septic systems 30 years or older in residential areas.

<sup>8</sup> Any river or stream that is culverted for distance greater than a simple roadway crossing.

<sup>9</sup> Outfalls/interconnections with water flow observed during dry weather inspection/sampling events.



The Town of Chelmsford

## Appendix C

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Field Forms, Sample Bottle Labels, Chain of Custody Form, and SOPs



# TOWN OF CHELMSFORD

## OUTFALL INSPECTION FORM

Outfall ID: \_\_\_\_\_ Street: \_\_\_\_\_

Date: \_\_\_\_\_ Time: \_\_\_\_\_

Watershed: \_\_\_\_\_

Temperature: \_\_\_\_\_

Weather: Sunny P. Cloudy Cloudy Rainy Drizzle

Flow: Yes No Submerged: Yes No Partially

Owner: Town State Private Unknown

Inspector's Name: \_\_\_\_\_

Precipitation Total in last 24 hours (inches): \_\_\_\_\_

Dry Weather / Wet Weather (>.1 inch rainfall in last 24 hours)

### OUTFALL CONDITION

|                            | ODOR<br>(Sewage, Rancid, Gasoline, Sulfide) | WATER COLOR<br>(Clear, Brown, Grey, Yellow, Green, Orange, Red, Other) | TURBIDITY<br>(Clear, Cloudy, Opaque) | FLOATABLES/POLUTANTS<br>(Sewage, Toilet Paper, Petroleum, Soapy Bubbles, Trash, Other) | VEGETATIVE CONDITIONS<br>(Excessive Growth, Inhibitive Growth, Beaver Dam, Normal) | TYPE OF OUTFALL<br>(Pipe Open End, Headwall, FES, Swale, Catch Basin Piped in to Culvert) | OUTFALL DAMAGE | DEPOSITS /STAINS | POOR POOL QUALITY | PIPE BENTHIC GROWTH |
|----------------------------|---|--|--------------------------------------|--|--|---|----------------|------------------|-------------------|---------------------|
| DESCRIPTION                |   |  |                                      |  |  |   |                |                  |                   |                     |
| SEVERITY 1-3<br>(Low-High) |   |  |                                      |  |  |   |                |                  |                   |                     |

### PIPE CONDITION

| MATERIAL<br>(Concrete, Asbestos Concrete, PVC, Corrugated Metal, Clay Tile, HDPE, Ductile Iron, CPP, Other) | CONDITION<br>(Good, Fair, Poor, Crumbling, Buried) | SHAPE<br>(Round, Rectangular, Swale) | INSIDE DIAMETER (in) | OUTSIDE DIAMETER (in) | WIDTH (in) | HEIGHT (in) |
|---|--|--------------------------------------|----------------------|-----------------------|------------|-------------|
|   |  |                                      |                      |                       |            |             |

**HEADWALL CONDITION**

| CONDITION<br>(Good, Fair, Poor<br>Crumbling) | TYPE<br>(Circular, Arch, Box,<br>Other) | MATERIAL<br>(Stone, Concrete,<br>Other) |
|--|---|---|
|  |   |   |

**SWALE CONDITION**

| CONDITION<br>(Good, Fair, Poor,<br>Crumbling) | MATERIAL<br>(Asphalt, Earthen,<br>Brick, Concrete,<br>Block, Stone, Other) | TYPE<br>(Rounded, Trapezoidal,<br>Triangular,<br>Rectangular) | WIDTH (in) | HEIGHT (in) | BOTTOM WIDTH (in) | DATE OF LAST<br>MAINTENANCE |
|---|--|---|------------|-------------|-------------------|-----------------------------|
|   |  |   |            |             |                   |                             |

**WATER SAMPLING RESULTS**

| AMMONIA<br>( ≥ 0.5 mg/L) | CHLORINE<br>( ≥ 0.02 mg/L) | SURFACTANTS<br>( ≥ 0.25 mg/L) | CONDUCTIVITY<br>(μS/cm) | SALINITY<br>(ppm) | E. COLI<br>(cfu/100mL) | TEMPERATURE<br>(°F) | PHOSPHOROUS<br>(mg/L) | WATER COLLECTED<br>FROM FLOW OR POOL | OBM TRAP SET<br>(Y/N) |
|--------------------------|----------------------------|-------------------------------|-------------------------|-------------------|------------------------|---------------------|-----------------------|--------------------------------------|-----------------------|
|                          |                            |                               |                         |                   |                        |                     |                       |                                      |                       |

**OUTFALL DISCHARGE LOCATION**

| GENERAL BODY OF WATER<br>(River, Stream, Lake, Wetland, Culvert,<br>Detention Area, Drainage Manhole, Infiltrator,<br>Parking Lot, Swale, Field, Farmland, Unkown, Other) | NAME |
|---|------|
|   |      |

Notes: \_\_\_\_\_

\_\_\_\_\_

**Nashoba Analytical, LLC**  
 31A Willow Rd, Ayer, MA 01432  
 Tel: 978-391-4428 Fax: 978-391-4643

## Chain of Custody

Client/Project Name: \_\_\_\_\_

Laboratory Number: \_\_\_\_\_

Sampled by: \_\_\_\_\_

| Sample # | Date | Time | Grab[G] or Composite[C] | Location | Container (Glass) (Plastic) (Sterile) (VOC) | Preservative | Test Requirements |  |  |  |  |  |  |  |  |  | Comments |  |  |  |
|----------|------|------|-------------------------|----------|---|--------------|-------------------|--|--|--|--|--|--|--|--|--|----------|--|--|--|
|          |      |      |                         |          |   |              |                   |  |  |  |  |  |  |  |  |  |          |  |  |  |
| 1        |      |      |                         |          |   |              |                   |  |  |  |  |  |  |  |  |  |          |  |  |  |
| 2        |      |      |                         |          |   |              |                   |  |  |  |  |  |  |  |  |  |          |  |  |  |
| 3        |      |      |                         |          |   |              |                   |  |  |  |  |  |  |  |  |  |          |  |  |  |
| 4        |      |      |                         |          |   |              |                   |  |  |  |  |  |  |  |  |  |          |  |  |  |
| 5        |      |      |                         |          |   |              |                   |  |  |  |  |  |  |  |  |  |          |  |  |  |
| 6        |      |      |                         |          |   |              |                   |  |  |  |  |  |  |  |  |  |          |  |  |  |
| 7        |      |      |                         |          |   |              |                   |  |  |  |  |  |  |  |  |  |          |  |  |  |
| 8        |      |      |                         |          |   |              |                   |  |  |  |  |  |  |  |  |  |          |  |  |  |
| 9        |      |      |                         |          |   |              |                   |  |  |  |  |  |  |  |  |  |          |  |  |  |
| 10       |      |      |                         |          |   |              |                   |  |  |  |  |  |  |  |  |  |          |  |  |  |

Preservative: 1-Hydrochloric Acid, 2- Ice, 3-Nitric Acid, 4-None, 5-Sodium Hydroxide, 6-Sulfuric Acid, 7-Thiosulfate, 8-Filter Sterilized, 9-Ammonium Chloride

|  |                  |      |      |              |
|--|------------------|------|------|--------------|
| Special Notes/Requirements   | Relinquished by: | Date | Time | Received by: |
| <input type="checkbox"/> <b>IF THIS BOX IS CHECKED, MCL EXCEEDANCES MUST BE REPORTED IMMEDIATELY. THANK YOU.</b> | 1.               |      |      |              |
|  | 2.               |      |      |              |
|  | 3.               |      |      |              |
|  | 4.               |      |      |              |
|  | 5.               |      |      |              |

# NASHOBA ANALYTICAL, LLC

31A Willow Road

Ayer, MA 01432 978-391-4428

www.nashobaanalytical.com

Laboratory Sample Label

## FIELD SAMPLE

- |   |  |
|---|--|
| <input type="checkbox"/> GROUND WATER   | <input type="checkbox"/> SURFACE WATER |
| <input type="checkbox"/> DRINKING WATER | <input type="checkbox"/> SOIL          |
| <input type="checkbox"/> INFLUENT       | <input type="checkbox"/> EFFLUENT      |
| <input type="checkbox"/> GRAB           | <input type="checkbox"/> COMPOSITE     |

CLIENT

SITE

ID

WELL NO.

TAKEN BY

DATE

TIME

PRESERVATIVE:  NONE

COOL 4°C

H<sub>2</sub>SO<sub>4</sub>  HCL  HNO<sub>3</sub>

NaOH

FILTERED  NOT FILTERED

TEFLON LINER

ANALYSIS:  RADON

VOC

BOD, TSS, TURB, T-P



## SOP 1: 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. SOP 2, “Wet Weather Outfall Inspection”, covers the objectives of that type of inspection. This SOP discusses the dry weather inspection objectives, and how they differ from wet weather inspection objectives.

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 13, “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 10, “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 indicator 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 SOP 13, “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.

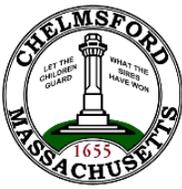
If the results of screening using field test kits indicate that the outfall’s water quality exceeds the benchmarks provided, collection of discrete analytical samples should be considered.

### *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.



*Chelmsford Stormwater Program  
Standard Operating Procedures  
SOP 1: Dry Weather Outfall Inspection*

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.

#### *Attachments*



*Chelmsford Stormwater Program  
Standard Operating Procedures  
SOP 1: Dry Weather Outfall Inspection*

1. Dry Weather Outfall Inspection Survey

*Related Standard Operating Procedures*

1. SOP 2, Wet Weather Outfall Inspection
2. SOP 10, Locating Illicit Discharges
3. SOP 13, Water Quality Screening in the Field



## SOP 2: WET 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. SOP 1, “Dry Weather Outfall Inspection”, covers the objectives of that type of inspection. This SOP discusses wet weather inspection objectives and how they differ from dry weather inspection objectives. The primary difference is that wet weather inspection aims to describe and evaluate the first flush of stormwater discharged from an outfall during a storm, representing the maximum pollutant load managed by receiving water.

### *Definition of Wet Weather*

A storm is considered a representative wet weather event if greater than 0.1 inch of rain falls and occurs at least 72 hours after the previously measurable (greater than 0.1 inch of rainfall) storm event. In some watersheds, based on the amount of impervious surface present, increased discharge from an outfall may not result from 0.1 inch of rain. An understanding of how outfalls respond to different events will develop as the inspection process proceeds over several months, allowing the inspectors to refine an approach for inspections.

Ideally, the evaluation and any samples collected should occur within the first 30 minutes of discharge to reflect the first flush or maximum pollutant load.

Typical practice is to prepare for a wet weather inspection event when weather forecasts show a 40% chance of rain or greater. If the inspector intends to collect analytical samples, coordination with the laboratory for bottleware and for sample drop-off needs to occur in advance.

### *Visual Condition Assessment*

The attached Wet Weather Outfall Inspection Survey should be used to document observations related to the quality of stormwater conveyed by the structure. Observations such as the following can indicate sources of pollution within the storm drain system:

- Oil sheen
- Discoloration
- Trash and debris

For any visual observation of pollution in a stormwater outfall discharge, 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 or 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.

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 10, “Locating Illicit Discharges”.

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.

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.

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 Wet 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 indicator 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 or by discrete analytical samples processed by a laboratory.

Information on how to use field test kits is included in SOP 13, “Water Quality Screening with Field Test Kits”, and the Wet Weather Outfall Inspection Survey includes fields to document the results of such screening. The Inspection Survey also provides values for what can be considered an appropriate benchmark for a variety of parameters that can be evaluated with field test kits.

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 wet 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 contaminant 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.

#### *Attachments*



*Chelmsford Stormwater Program  
Standard Operating Procedures  
SOP 2: Wet Weather Outfall Inspection*

1. Wet Weather Outfall Inspection Survey

*Related Standard Operating Procedures*

1. SOP 1, Dry Weather Outfall Inspection
2. SOP 10, Locating Illicit Discharges
3. SOP 13, Water Quality Screening in the Field

ENGINEERING 978-250-5228  
FACILITIES 978-244-3379  
HIGHWAY 978-250-5270



PARKS 978-250-5228  
SEWER (OFFICE) 978-250-5233  
(OPERATIONS) 978-250-5297

## DEPARTMENT OF PUBLIC WORKS

9 Alpha Road  
Chelmsford, MA 01824

Gary J. Persichetti, CFM  
Director

Telephone: 978-250-5228  
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### SWMP 6-5 CATCH BASIN INSPECTION AND CLEANING

#### *Introduction*

Catch basins help minimize flooding and protect water quality by removing trash, sediment, decaying debris, and other solids from stormwater runoff. These materials are retained in a sump below the invert of the outlet pipe. Catch basin cleaning reduces foul odors, prevents clogs in the storm drain system, and reduces the loading of suspended solids, nutrients, and bacteria to receiving waters.

During regular cleaning and inspection procedures, data can be gathered related to the condition of the physical basin structure and its frame and grate and the quality of stormwater conveyed by the structure. Observations such as the following can indicate sources of pollution within the storm drain system:

- Oil sheen
- Discoloration
- Trash and debris

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 a oil will remain intact and move in a swirl pattern; a sheen caused by bacteria will separate and appear "blocky". Bacterial sheen is not a pollutant but should be noted.

Observations such as the following can indicate a potential connection of a sanitary sewer to the storm drain system, which is an illicit discharge.

- Indications of sanitary sewage, including fecal matter or sewage odors
- Foaming, such as from detergent
- Optical enhancers, fluorescent dye added to laundry detergent

Each catch basin should be cleaned and inspected at least annually. Catch basins in high-use areas may require more frequent cleaning. Performing street sweeping on an appropriate schedule will reduce the amount of sediment, debris, and organic matter entering the catch basins, which will in turn reduce the frequency with which structures need to be cleaned.

#### *Operations*

- Prioritize inspection and maintenance for catch basins located near construction activities. Clean catch basins in such areas more frequently if inspection and maintenance activities indicate excessive sediment or debris loadings.
- Establish a schedule with a goal that the frequency of routine cleaning will ensure that no catch basin at any time will be more than 50% full.
- If a catch basin sump is more than 50% full during two consecutive routine inspections/ cleaning events we will document that finding, and investigate the contributing drainage area for sources of excessive sediment loading, and to the maximum extent practicable, abate contributing sources. We will describe any actions taken in our annual report.

- Excessive sediment or debris loading is a catch basin sump more than 50% full. A sump is more than 50% full when the contents within the sump exceed one half the distance between the bottom interior of the catch basin to the invert of the deepest outlet of the catch basin.
- In our annual SWMP, we will document the plan for optimizing catch basin cleaning, inspection plans or schedule for gathering information to develop the optimization plan. Documentation shall include metrics and other information used to reach the determination that the established plan for cleaning and maintenance is optimal for our Town. We will keep a log of catch basins cleaned or inspected.
- We will report annually on the total number of catch basins, number inspected, number cleaned and the total volume or mass of material removed from all catch basins.

### *Cleaning Procedure*

Catch basin inspection cleaning procedures should address both the grate opening and the basin's sump. Document any and all observations about the condition of the catch basin structure and water quality on the Catch Basin Inspection Form (attached).

Catch basin inspection and cleaning procedures include the following:

1. Work upstream to downstream.
2. Clean sediment and trash off grate.
3. Visually inspect the outside of the grate.
4. Visually inspect the inside of the catch basin to determine cleaning needs.
5. Inspect catch basin for structural integrity.
6. Determine the most appropriate equipment and method for cleaning each catch basin.
  - a. Manually use a shovel to remove accumulated sediments, or
  - b. Use a bucket loader to remove accumulated sediments, or
  - c. When available, use a high pressure washer to clean any remaining material out of catch basin while capturing the slurry with a vacuum.
  - d. If necessary, after the catch basin is clean, use the rodder of the vacuum truck to clean downstream pipe and pull back sediment that might have entered downstream pipe.
7. If contamination is suspected, chemical analysis will be required to determine if the materials comply with the Massachusetts DEP Hazardous Waste Regulations, 310 CMR 30.000 (<http://www.mass.gov/dep/service/regulations/310cmr30.pdf>). Chemical analysis required will depend on suspected contaminants. Note the identification number of the catch basin on the sample label, and note sample collection on the Catch Basin Inspection Form.
8. Properly dispose of collected sediments. See following section for guidance.
  - a. <http://www.mass.gov/eea/agencies/massdep/recycle/regulations/management-of-catch-basin-cleanings.html>
9. If fluids collected during catch basin cleaning are not being handled and disposed of by a third party, dispose of these fluids to a sanitary sewer system, with permission of the system operator.
10. If illicit discharges are observed or suspected, notify the appropriate Department.
11. At the end of each day, document location and number of catch basins cleaned, amount of waste collected, and disposal method for all screenings.
12. Report additional maintenance or repair needs to the appropriate Department.

### *Disposal of Screenings*

Catch basin cleanings from storm water-only drainage systems may be disposed at any landfill that is permitted by MassDEP to accept solid waste. MassDEP does not routinely require stormwater-only catch basin cleanings to be tested before disposal, unless there is evidence that they have been contaminated by a spill or some other means.

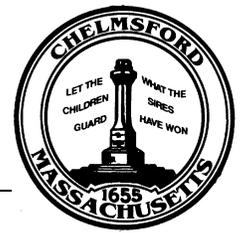
Screenings may need to be placed in a drying bed to allow water to evaporate before proper disposal. In this case, ensure that the screenings are managed to prevent pollution.

---

Approved by Public Works Director (or authorized official)

Date

SWMP 6-5 CATCH BASIN INSPECTION FORM



Inspector: \_\_\_\_\_ Date: \_\_\_\_\_ Street: \_\_\_\_\_

|                           |   |  |   |
|---------------------------|---|--|---|
| <b>Catch Basin I.D.</b>   |   | <b>Final Discharge from Structure?</b> Yes <input type="checkbox"/> No <input type="checkbox"/><br><b>If Yes, Discharge to Outfall No:</b> _____ |   |
| <b>Catch Basin Label:</b> | Stencil <input type="checkbox"/> Ground Inset <input type="checkbox"/> Sign <input type="checkbox"/> None <input type="checkbox"/> Other _____  |  |   |
| <b>Basin Material:</b>    | Concrete <input type="checkbox"/><br>Corrugated metal <input type="checkbox"/><br>Stone <input type="checkbox"/><br>Brick <input type="checkbox"/><br>Other: _____ <input type="checkbox"/> | <b>Catch Basin Condition:</b>  | Good <input type="checkbox"/> Poor <input type="checkbox"/><br>Fair <input type="checkbox"/> Crumbling <input type="checkbox"/> |
| <b>Pipe Material:</b>     | Concrete <input type="checkbox"/><br>HDPE <input type="checkbox"/><br>PVC <input type="checkbox"/><br>Clay Tile <input type="checkbox"/><br>Other: _____ <input type="checkbox"/>           | <b>Pipe Measurements:</b>  | Inlet Dia. (in): d= _____<br>Outlet Dia. (in): D= _____   |

|   |   |
|---|---|
| <b>Required Maintenance/ Problems (check all that apply):</b>   |   |
| <input type="checkbox"/> Tree Work Required<br><input type="checkbox"/> New Grate is Required<br><input type="checkbox"/> Pipe is Blocked<br><input type="checkbox"/> Frame Maintenance is Required<br><input type="checkbox"/> Remove Accumulated Sediment<br><input type="checkbox"/> Pipe Maintenance is Required<br><input type="checkbox"/> Basin Undermined or Bypassed | <input type="checkbox"/> Cannot Remove Cover<br><input type="checkbox"/> Ditch Work<br><input type="checkbox"/> Corrosion at Structure<br><input type="checkbox"/> Erosion Around Structure<br><input type="checkbox"/> Remove Trash & Debris<br><input type="checkbox"/> Need Cement Around Grate<br><b>Other:</b> _____ |

|  |                       |                                 |                                    |
|--|-----------------------|---------------------------------|------------------------------------|
| <b>Catch Basin Grate Type :</b>                | Depth before cleaning | <b>Sediment Buildup Depth :</b> | <b>Description of Flow:</b>        |
| Grate: <input type="checkbox"/>                | A= _____              | 0-6 (in): _____                 | Heavy <input type="checkbox"/>     |
| Bar: <input type="checkbox"/>                  | Depth after cleaning  | 6-12(in): _____                 | Moderate <input type="checkbox"/>  |
| Cascade: <input type="checkbox"/>              | B= _____              | 12-18 (in): _____               | Slight <input type="checkbox"/>    |
| Other: _____                                   | Depth of Sediment     | 18-24 (in): _____               | Trickling <input type="checkbox"/> |
| Properly Aligned: Yes <input type="checkbox"/> | B-A= _____            | 24 + (in): _____                | None <input type="checkbox"/>      |
| No <input type="checkbox"/>                    |                       |                                 |                                    |

|   |                              |                             |
|---|------------------------------|-----------------------------|
| <b>*If the outlet is submerged check yes and indicate approximate height of water above the outlet invert. h above invert (in):</b> _____ | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
|---|------------------------------|-----------------------------|

|  |  |                              |                   |
|--|--|------------------------------|-------------------|
| <input type="checkbox"/> Flow<br><input type="checkbox"/> Standing Water<br>(check one or both)              | <b>Observations:</b>   | <b>Circle those present:</b> |                   |
|  | Color: _____   | Foam                         | Oil Sheen         |
|  | Odor: _____  | Sanitary Waste               | Bacterial Sheen   |
| <b>Weather Conditions :</b>  | Dry > 24 hours <input type="checkbox"/> Wet <input type="checkbox"/> | Orange Staining              | Floatables        |
| <b>Sample of Screenings Collected for Analysis?</b> Yes <input type="checkbox"/> No <input type="checkbox"/> |  | Excessive sediment           | Pet Waste         |
| <b>Comments:</b>   |  | Other: _____                 | Optical Enhancers |
|  |  | None                         |                   |



## SOP 13: 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. SOP 1, “Dry Weather Outfall Inspection” and SOP 2, “Wet Weather Outfall Inspection”, cover the objectives of these activities and how water quality parameters can be collected during both types of inspections. SOP 3, “Catch Basin Inspection and Cleaning”, describes how this operations and maintenance activity can serve as an additional opportunity to collect water quality data.

SOP 2 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 SOP 10, “Locating Illicit Discharges”.

### *Visual Condition Assessment*

SOP 1, SOP 2, and SOP 3 describe a Visual Condition Assessment to collect observations related to the quality of stormwater conveyed by an engineered storm drain system. These observations may include such visual evidence and/or potential pollutants as:

- Foaming (detergents)
- Discoloration
- Evidence of sanitary waste
- Optical enhancers (fluorescent dyes added to laundry detergent); and
- Turbidity

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.

**Table SOP 13-1  
 Field Measurements, Test Kits, and Instrumentation**

| Analyte or Parameter     | Instrumentation (Portable meter)  | Field Test Kit  |
|--------------------------|---|---|
| Ammonia                  | CHEMetrics™ V-2000 Colorimeter<br>Hach™ DR/890 Colorimeter<br>Hach™ Pocket Colorimeter™ II    | CHEMetrics™ K-1410<br>CHEMetrics™ K-1510 (series)<br>Hach™ NI-SA<br>Hach™ Ammonia Test Strips                   |
| Bacteria                 | Bacteria field test kits require 24-hour window   |   |
| Boron                    | N/A   | Hanna™ HI 38074<br>Taylor™ K-1541   |
| Chloride                 | CHEMetrics™ V-2000 Colorimeter<br>Hach™ Pocket Colorimeter™ II<br>LaMotte™ DC1200 Colorimeter | CHEMetrics™ K-2002 through K-2070<br>Hach™ CDS-DT<br>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<br>Hach™ DE-2   |
| Fluoride                 | CHEMetrics™ V-2000 Colorimeter<br>Hach™ Pocket Colorimeter™ II                                | N/A   |
| Hardness                 | N/A   | CHEMetrics™ K-1705 and K-1710<br>CHEMetrics™ K-4502 through K-4530<br>Hach™ HA-DT<br>Hach™ Hardness Test Strips |
| Optical enhancers        | Field tests still under development   |   |
| pH                       | CHEMetrics™ I-1000  | Hach™ 17J through 17N<br>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.

**Table SOP 13-2  
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 Table SOP 13-1), and the costs are far less than full analyses at a laboratory. However, some disadvantages of this screening method include:

- Limited shelf life



*Chelmsford Stormwater Program  
Standard Operating Procedures  
SOP 13: Water Quality Screening In the Field*

- 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 Table SOP 13-1 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

*Related Standard Operating Procedures*

1. SOP 1, Dry Weather Outfall Inspection
2. SOP 2, Wet Weather Outfall Inspection
3. SOP 3, Catch Basin Cleaning and Inspection
4. SOP 10, Locating Illicit Discharges



The Town of Chelmsford

## Appendix D

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### Water Quality Analysis Instructions and User's Manuals

# Detergents CHEMets Kit

K-9400/R-9400: 0 - 3 ppm

## Test Procedure

1. Rinse the reaction tube with the sample to be tested, and then fill it to the 5 mL mark with the sample.
2. While holding the double-tipped ampoule in a vertical position, snap the upper tip using the tip breaking tool (fig. 1).
3. Invert the ampoule and position the open end over the reaction tube. Snap the upper tip and allow the contents to drain into the reaction tube (fig. 1).
4. Cap the reaction tube and shake it vigorously for **30 seconds**. Allow the tube to stand undisturbed for **1 minute**.
5. Make sure that the flexible tubing is firmly attached to the CHEMet ampoule tip.
6. Insert the CHEMet assembly (tubing first) into the reaction tube making sure that the end of the flexible tubing is at the bottom of the tube. Break the tip of the CHEMet ampoule by gently pressing it against the side of the reaction tube (fig. 2). The ampoule should draw in fluid only from the organic phase (bottom layer).
7. When filling is complete, remove the CHEMet assembly from the reaction tube.
8. Remove the flexible tubing from the CHEMet ampoule and wipe all liquid from the exterior of the ampoule. Place an ampoule cap firmly onto the tip of the CHEMet ampoule. Invert the ampoule several times, allowing the bubble to travel from end to end.

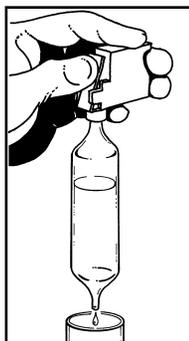


Figure 1

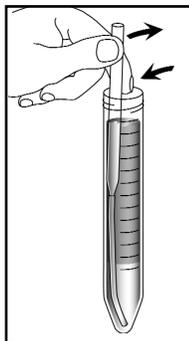


Figure 2

9. Obtain a test result by placing the ampoule, flat end first, into the comparator. Hold the comparator up toward a source of light and view from the bottom. Rotate the comparator until the best color match is found (fig. 3).

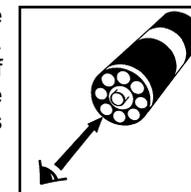


Figure 3

## Tip Breaker

The tip breaker opens for easy disposal of the glass tips (pull lever away from body of tip breaker or pull open the side wall). The tip breaker will work most effectively if the tips are emptied out frequently.

## Test Method

The Detergents CHEMets<sup>®1</sup> test kit employs the methylene blue extraction method<sup>2,3,4</sup>. Anionic detergents react with methylene blue to form a blue complex that is extracted into an immiscible organic solvent. The intensity of the blue color is directly related to the concentration of "methylene blue active substances (MBAS)" in the sample. Anionic detergents are one of the most prominent methylene blue active substances. Test results are expressed in ppm (mg/Liter) linear alkylbenzene sulfonate (equivalent weight 325).

1. CHEMets is a registered trademark of CHEMetrics, Inc. U.S. Patent No. 3,634,038
2. APHA Standard Methods, 21st ed., method 5540 C (2005)
3. EPA Methods for Chemical Analysis of Water and Wastes, method 425.1 (1983)
4. ASTM D 2330-02, Methylene Blue Active Substances

## Safety Information

Read MSDS (available at [www.chemetrics.com](http://www.chemetrics.com)) before performing this test procedure. Wear safety glasses and protective gloves.



[www.chemetrics.com](http://www.chemetrics.com)  
4295 Catlett Road, Midland, VA 22728 U.S.A.  
Phone: (800) 356-3072; Fax: (540) 788-4856  
E-Mail: [orders@chemetrics.com](mailto:orders@chemetrics.com)

Sept. 12, Rev. 9

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# INSTRUCTIONS ON USING YSI PRO30 TEST PROBE

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## Taking Measurements:

1. Place probe in water sample, making sure the water level is higher than the two holes near the cable.
2. Once the probe is submerged in the sample, give the probe a quick shake to release any air bubbles.
3. Let the readings on the display screen stabilize, then record measurements.

## Calibration:

1. Fill a clean container with the conductivity calibration solution (we used Ricca potassium chloride 1000  $\mu\text{S}/\text{cm}$ ).
2. Place the probe in to the container making sure the two holes near the top are submerged.
3. Gently shake to dislodge air bubbles.
4. Turn the instrument on and allow the conductivity and temperature readings to stabilize.
5. Press the "cal" key
6. Highlight conductivity and press enter
7. Select the desired calibration method (we used specific conductance)
8. Highlight the units you wish to calibrate (we used  $\mu\text{S}/\text{cm}$ )
9. Use the up and down arrow keys to match the value displayed to the value of the calibration solution
10. Press enter to complete the calibration. Calibration successful will be displayed.

---

# HACH CHLORINE TESTING POCKET COLORIMETER INSTRUCTIONS

---

1. Rinse out one of the glass vials **3 times** using the water sample collected from the outfall.
2. Fill the vial with 10 mL of the water sample collected from the outfall. Clean the vial with a lint-free cloth.
3. Turn on the colorimeter. When the display screen appears, make sure there is an arrow below the “LR” (low range) marking in the top left hand corner of the screen.<sup>i</sup>
4. Remove the cap of the colorimeter, and place the 10 mL sample in the instrument. The diamond marking on the vial should be facing **toward the keypad** of the colorimeter.
5. Place cap of colorimeter over vial.
6. Press the blue zero button. Wait until the display screen reads “0.00”, then remove the cap and the vial.
7. Using the same 10 mL vial that was used to zero the instrument, put 1 packet of the “Total Chlorine Reagent” into the sample. **Shake for 20 seconds.**
8. Within **3-6 minutes** after shaking, steps 9 & 10 must be completed.
9. Clean the vial again with a lint-free cloth. Place vial back into colorimeter, ensuring that the diamond marking of the vial is facing **toward the keypad**. Place colorimeter cover over the vial.
10. Press the green button, and the display screen will show the concentration of total chlorine in the sample. Record the reading.
11. Rinse out the vial used for the experiment with distilled water **3 times**.

---

<sup>i</sup> If the arrow is not below the “LR” marking on the colorimeter: 1) Press the menu button. 2) Scroll through the options by pressing the blue button until “SEL” appears on the display screen. 3) Press the green button to toggle between “LR” and “HR”. Once “LR” is selected, hit the menu button again to exit.



# Pro30



## USER MANUAL

English

# CONTENTS

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## WARRANTY

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The YSI Professional 30 instrument (Pro30) is warranted for three (3) years from date of purchase by the end user against defects in materials and workmanship, exclusive of batteries and any damage caused by defective batteries. Pro30 cable/probe assemblies are warranted for two (2) years from date of purchase by the end user against defects in material and workmanship. Pro30 instruments & cables are warranted for 90 days from date of purchase by the end user against defects in material and workmanship when purchased by rental agencies for rental purposes. Within the warranty period, YSI will repair or replace, at its sole discretion, free of charge, any product that YSI determines to be covered by this warranty.

To exercise this warranty, call your local YSI representative, or contact YSI Customer Service in Yellow Springs, Ohio at +1 937 767-7241, 800-897-4151 or visit [www.YSI.com](http://www.YSI.com) for a Product Return Form. Send the product and proof of purchase, transportation prepaid, to the Authorized Service Center selected by YSI. Repair or replacement will be made and the product returned, transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days from date of repair or replacement.

### LIMITATION OF WARRANTY

This Warranty does not apply to any YSI product damage or failure caused by:

1. Failure to install, operate or use the product in accordance with YSI's written instructions;
2. Abuse or misuse of the product;
3. Failure to maintain the product in accordance with YSI's written instructions or standard industry procedure;
4. Any improper repairs to the product;
5. Use by you of defective or improper components or parts in servicing or repairing the product;
6. Modification of the product in any way not expressly authorized by YSI.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. YSI'S LIABILITY UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT, AND THIS SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY. IN NO EVENT SHALL YSI BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY.

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## INTRODUCTION

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Thank you for purchasing the YSI Pro30, an instrument from the YSI *Professional Series* product family. The Pro30 measures conductivity and temperature in water. The Pro30 features an impact resistant and waterproof (IP-67) case, a rugged MS-8 (military-spec) cable connector, backlit display, user-selectable sensor options, 50 data set memory, internal barometer and a rubber over-mold case.

The Pro30 provides valuable instructions and prompts near the bottom of the display that will guide you through operation and use. However, reading the entire manual is recommended for a better understanding of the instrument's features.



*The Pro30 cannot communicate to a PC via a Pro Series communications saddle. Connecting the Pro30 to a communication saddle may cause erratic instrument behavior.*

## GETTING STARTED

---

### INITIAL INSPECTION

---

Carefully unpack the instrument and accessories and inspect for damage. Compare received parts with items on the packing list. If any parts or materials are damaged or missing, contact YSI Customer Service at 800-897-4151 (+1 937 767-7241) or the authorized YSI distributor from whom the instrument was purchased.

### BATTERY INSTALLATION

---

The instrument requires 2 alkaline C-cell batteries. Under normal conditions, the average battery life is 425 hours at room temperature without using the back light. A battery symbol  will blink in the lower, left corner of the display to indicate low batteries when approximately 1 hour of battery life remains.

To install or replace the batteries:

1. Turn the instrument off and flip over to view the battery cover on the back.
2. Unscrew the four captive battery cover screws.
3. Remove the battery cover and remove the old batteries if necessary.
4. Install the new batteries, ensuring correct polarity alignment (figure 1).

- Place the battery cover on the back of the instrument and tighten the four screws. Do not over-tighten.

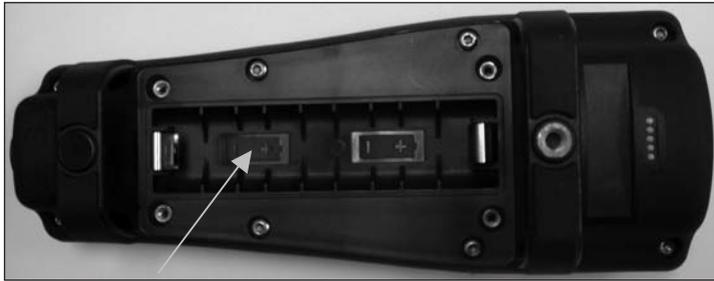


Figure 1. Pro30 with battery cover removed. Notice battery symbols indicating polarities.

**i** The waterproof instrument case is sealed at the factory and is not to be opened, except by authorized service technicians. Do not attempt to separate the two halves of the instrument case as this may damage the instrument, break the waterproof seal, and will void the warranty.

## KEY PAD

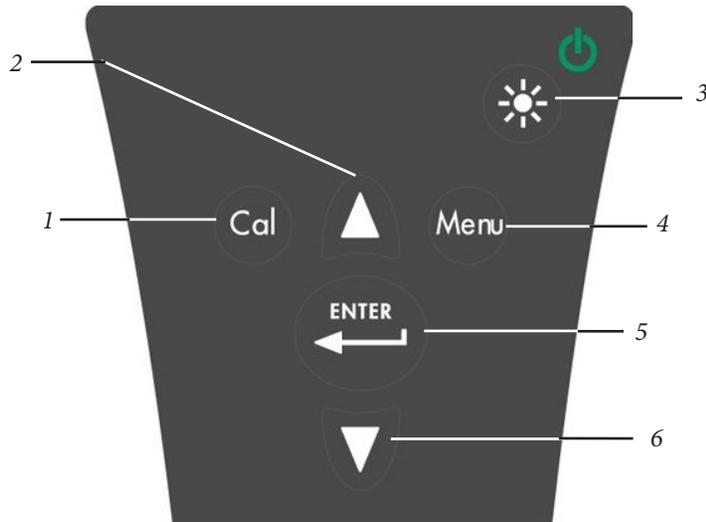


Figure 2, Keypad

| Number | Key | Description  |
|--------|-----|--|
| 1      |     | <b>Calibrate</b><br>Press and hold for 3 seconds to calibrate. Opens Calibrate menu from the Run screen.   |
| 2      |     | <b>Up Arrow</b><br>Use to navigate through menus, to navigate through box options along the bottom of the Run screen and to increase numerical inputs.   |
| 3      |     | <b>Power and Backlight</b><br>Press once to turn instrument on. Press a second time to turn backlight on. Press a third time to turn backlight off. Press and hold for 3 seconds to turn instrument off. |
| 4      |     | <b>Menu</b><br>Use to enter the System Setup menu from the Run screen.   |
| 5      |     | <b>Enter</b><br>Press to confirm entries and selections.   |
| 6      |     | <b>Down Arrow</b><br>Use to navigate through menus, to navigate through box options at the bottom of the Run screen and to decrease numerical inputs.  |

## CONNECTING THE PROBE/CABLE ASSEMBLY TO THE INSTRUMENT

The conductivity and temperature sensors are integral to the cable assembly; therefore, they cannot be removed from the cable.

To connect the cable, align the keys on the cable connector to the slots on the instrument connector. Push together firmly and then twist the outer ring until it locks into place (figure 3). This connection is water-proof.



Figure 3, Note the keyed connector.

## RUN SCREEN

Press the power/backlight key  to turn the instrument on. The instrument will run through a self test and briefly display a splash screen with system information before displaying the main Run screen (figure 4). The first time the Pro30 is turned on, it will prompt you to select a language; see the First Power On section of this manual for more information.

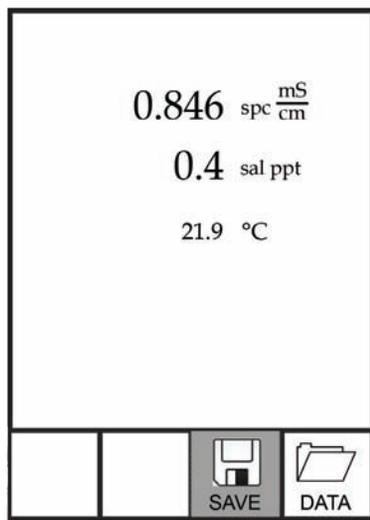


Figure 4, Run screen.

## BACKLIGHT

Once the instrument is powered on, pressing the power/backlight key  will turn on the display backlight. The backlight will remain on until the key is pressed again or after two minutes of not pressing any key on the keypad.

## POWERING OFF

To turn the instrument off, press and hold the power/backlight key  for three seconds.

## NAVIGATION

The up  and down  arrow keys allow you to navigate through the functions of the Pro30.

### NAVIGATING THE RUN SCREEN

When in the Run screen, the up  and down  arrow keys will move the highlighted box along the bottom options. Once a box is highlighted, press enter to access the highlighted option.

Description of Run screen box functions from left to right:

| Option  | Description   |
|---|---|
| <br>SAVE   | Highlight and press enter to save displayed data to memory. |
| <br>DATA | Highlight and press enter to view and/or erase saved data.  |

### NAVIGATING THE SYSTEM SETUP MENU

When in the System Setup menu, the up and down arrow keys will move the highlighted bar up and down the system setup options. See the System Setup menu section of this manual for more information about these options.

## FIRST POWER ON

The instrument will step through an initial language configuration when powered on for the first time. Use the up or down arrow keys to highlight the

appropriate language then press enter to confirm (figure 5). If an incorrect language is selected, it may be changed in the System Setup menu.

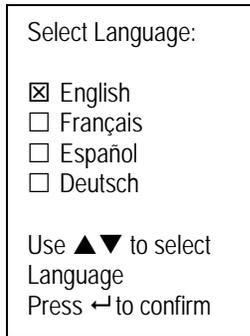


Figure 5, Select language.

After selecting a language, the Run screen will be displayed. The next time the instrument is powered up, the Run screen will display immediately after the splash screen.

## SYSTEM SETUP MENU

---

Press the menu  key to access the System Setup menu. The System Setup menu contains multiple screens that are notated as 'pages'. The current page is indicated near the bottom of the display (figure 6).

Use the up and down arrow keys to scroll through menu options and menu pages.

### EXITING THE SYSTEM SETUP MENU

---

To exit the System Setup menu, press the down arrow key until the ESC - Exit box is highlighted, then press enter to return to the Run screen.

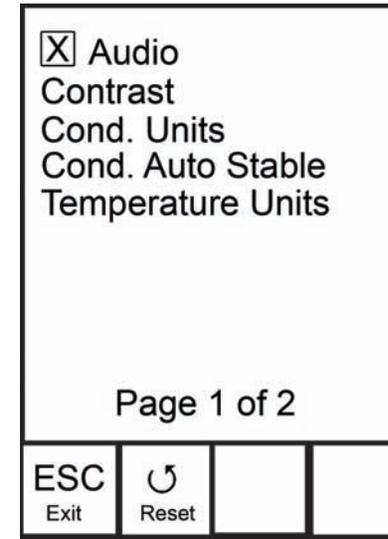


Figure 6, page 1 of System Setup menu. Audio is enabled.

## AUDIO

---

Audio can be enabled or disabled by using the up or down arrow keys to highlight Audio and pressing enter. When enabled, there will be an 'X' in the box next to Audio.

When Audio is enabled, the Pro30 will beep twice to indicate stability when Auto Stable is enabled. The instrument will also beep when a key is pressed. When Audio is disabled, the Pro30 will not beep.

## CONTRAST

---

To adjust the display Contrast, use the up or down arrow keys to highlight Contrast, then press enter. Next, use the up or down arrow keys to adjust the contrast. The up arrow key will darken the contrast and the down arrow key will lighten the contrast. After adjusting the contrast, press enter to save and exit the Contrast adjustment option.

### EMERGENCY CONTRAST ADJUSTMENT

---

If necessary, there is an alternate method of adjusting the contrast. To adjust the contrast, press and hold the menu key, then press the up arrow key to darken the contrast or press the down arrow key to lighten the contrast.

## CONDUCTIVITY UNITS (COND. UNITS)

---

Highlight Cond. Units (Conductivity Units) and press enter to open a submenu that allows you to select the conductivity units to be displayed on the Run screen. Highlight a unit and press enter to enable or disable it. An enabled conductivity unit will have an 'X' in the box next to it. Highlight the ESC-Exit box along the bottom of the display and press enter to save any changes and to close the conductivity units submenu.

There are seven options for displaying conductivity. Only four units can be enabled at the same time:

- COND-mS/cm displays conductivity in milliSiemens per centimeter.
- COND-uS/cm displays conductivity in microSiemens per centimeter.
- SPC-mS/cm displays Specific Conductance in milliSiemens per centimeter. Specific Conductance is temperature compensated conductivity.
- SPC-uS/cm displays Specific Conductance in microSiemens per centimeter. Specific Conductance is temperature compensated conductivity.
- Sal ppt displays salinity in parts per thousand. The salinity reading is calculated from the instrument's conductivity and temperature values using algorithms found in *Standard Methods for the Examination of Water and Wastewater*.
- TDS g/L displays Total Dissolved Solids in grams per liter. TDS is calculated from conductivity and temperature using a user-selectable TDS constant.
- TDS mg/L displays Total Dissolved Solids in milligrams per liter. TDS is calculated from conductivity and temperature using a user-selectable TDS constant.

Note: 1 milliSiemen = 1,000 microSiemens.

---

## SPECIFIC CONDUCTANCE

---

The conductivity of a sample is highly dependent on temperature, varying as much as 3% for each change of one degree Celsius (temperature coefficient = 3%/°C). In addition, the temperature coefficient itself varies with the nature of the ionic species present in the sample. Therefore, it is useful to compensate for this temperature dependence in order to quickly compare conductivity readings taken at different temperatures.

The Pro30 can display non-temperature compensated conductivity as well as temperature compensated Specific Conductance. If Specific Conductance is selected, the Pro30 uses the temperature and conductivity values associated with

each measurement to calculate a specific conductance value compensated to a user selected reference temperature, see below. Additionally, the user can select the temperature coefficient from 0% to 4%.

Using the Pro30's default reference temperature and temperature coefficient (25 °C and 1.91%), the calculation is carried out as follows:

$$\text{Specific Conductance (25°C)} = \frac{\text{Conductivity of sample}}{1 + 0.0191 * (T - 25)}$$

T = Temperature of the sample in °C

---

## CONDUCTIVITY AUTO STABLE (COND. AUTO STABLE)

---

Auto Stable utilizes preset values to indicate when a reading is stable. The preset values are adjustable in the System Setup menu. The user can input a % change in readings (0.0 to 1.9) over 'x' amount of time in seconds (3-19).

Highlight Cond. Auto Stable, then press enter to open the submenu.

Use the up or down arrow keys to highlight the % change or seconds (secs) input field, then press enter to make the highlighted field adjustable. Use the up or down arrow keys to adjust the selected value, then press enter to confirm changes. Once you have confirmed any changes, highlight the ESC-Exit box along the bottom of the display and press enter to close the Auto Stable submenu.

To disable Auto Stable, set the % Change input to 0.0.

When Auto Stable is enabled, an  $\text{AS}$  symbol will display next to the reading on the Run screen and blink during stabilization. When the dissolved oxygen and/or conductivity reading stabilizes based on the Auto Stable settings, the  $\text{AS}$  symbol will display steadily and the instrument will beep twice if Audio is turned on.

---

## TEMPERATURE UNITS

---

Highlight Temperature Units and press enter to open a submenu that allows you to change the temperature units displayed on the Run screen. Highlight the desired unit (Celsius or Fahrenheit) and press enter to enable. The enabled temperature unit will have an 'X' in the box next to it. Only one unit may be enabled at a time. Highlight the ESC-Exit box and press enter to save any changes and to close the Temperature Units submenu.

## **SPECIFIC CONDUCTANCE REFERENCE TEMPERATURE (SPC REF. TEMP.)**

---

SPC Ref. Temp. (Specific Conductance Reference Temperature) is the reference temperature used to calculate Specific Conductance. The reference temperature range is 15 and 25 °C. The default value is 25 °C.

To change the reference temperature, highlight SPC Ref. Temp. and press enter to open the submenu. With the reference temperature highlighted, press enter to make the field adjustable. Next, use the up or down arrow key to increase or decrease the value. Press enter to save the new reference temperature. Next, highlight the ESC-Exit box and press enter to close the submenu.

## **SPECIFIC CONDUCTANCE TEMPERATURE COEFFICIENT (SPC %/°C)**

---

SPC %/°C (Specific Conductance Temperature Coefficient) is the temperature coefficient used to calculate Specific Conductance. The coefficient range is 0.00 to 4.00. The default value is 1.91% which is based on KCl standards.

To change the temperature coefficient, highlight SPC %/°C and press enter to open the submenu. With the temperature coefficient highlighted, press enter to make the field adjustable. Next, use the up or down arrow key to increase or decrease the value. Press enter to save the new coefficient. Next, highlight the ESC-Exit box and press enter to close the submenu.

## **TDS CONSTANT**

---

TDS Constant is a multiplier used to calculate an estimated TDS (Total Dissolved Solids) value from conductivity. The multiplier is used to convert Specific Conductance in mS/cm to TDS in g/L. The Pro30's default value is 0.65. This multiplier is highly dependent on the nature of the ionic species present in the water sample. To be assured of moderate accuracy for the conversion, you must determine a multiplier for the water at your sampling site. Use the following procedure to determine the multiplier for a specific sample:

1. Determine the specific conductance of a water sample from the site;
2. Filter a sample of water from the site;
3. Completely evaporate the water from a carefully measured volume of the filtered sample to yield a dry solid;
4. Accurately weigh the remaining solid;
5. Divide the weight of the solid (in grams) by the volume of water used (in liters) to yield the TDS value in g/L for this site;
6. Divide the TDS value in g/L by the specific conductance of the water in mS/cm to yield the conversion multiplier. Be certain to use the correct units.

If the nature of the ionic species at the site changes between sampling studies, the TDS values will be in error. TDS cannot be calculated accurately from specific conductance unless the make-up of the chemical species in the water remains constant.

To change the TDS Constant in the Pro30, highlight TDS Constant and press enter to open the submenu. With the TDS Constant highlighted, press enter to make the field adjustable. Next, use the up or down arrow key to increase or decrease the value. The input range is 0.30 to 1.00. Press enter to save the new TDS Constant. Next, highlight the ESC-Exit box and press enter to close the submenu.

## **LANGUAGE**

---

Highlight Language and press enter to open a submenu that allows you to change the language. Highlight the desired language (English, Spanish, German, or French) and press enter to enable. The enabled language will have an 'X' in the box next to it. Highlight ESC-Exit box and press enter to save any changes and to close the Language submenu.

The text in the boxes along the bottom of the Run screen will always be displayed in English regardless of the language enabled in the System Setup menu.

## **AUTO SHUTOFF**

---

Auto Shutoff allows you to set the instrument to turn off automatically after a period of time. Use the up or down arrow keys to highlight Auto Shutoff, then press enter to open the submenu. Press enter while the minute field is highlighted to make it adjustable. Next, use the up or down arrow keys to adjust the shut off time from 0 to 60 minutes. Press enter to save the new shutoff time. Next, highlight the ESC-Exit box and press enter to close the submenu.

To disable Auto Shutoff, set the Time in Minutes to 0 (zero).

## **CELL CONSTANT**

---

The Cell Constant displays the cell constant of the conductivity cell. The cell constant is calculated and updated each time a conductivity calibration is performed. The cell constant range is 4.0 to 6.0. Resetting the System Menu resets the cell constant to 5.0.

## RESETTING THE SYSTEM SETUP MENU TO FACTORY DEFAULT

To reset the Pro30 settings to factory default, press the down arrow key while in the System Setup menu until the Reset -  box is highlighted, then press enter. The instrument will ask you to confirm the reset. Highlight Yes and press enter to continue with the reset or highlight No and press enter to cancel the reset. A Factory Reset will not affect data saved in the instrument's memory.

The following will be set in the Pro30 after performing a reset:

| <i>Parameter</i>            | <i>Reset Defaults</i>                        |
|-----------------------------|--|
| Audio                       | On   |
| Contrast                    | Set to mid range                             |
| Conductivity Units          | cond uS/cm, spc mS/cm, spc uS/cm and sal ppt |
| Conductivity Auto Stable    | Off (0.0 % Change and 10 seconds)            |
| SPC Reference Temperature   | 25°C   |
| SPC Temperature Coefficient | 1.91%/°C                                     |
| TDS Constant                | 0.65   |
| Temperature Units           | °C   |
| Language                    | English                                      |
| Auto Shutoff                | 30 minutes                                   |
| Conductivity Cell Constant  | Cell constant reset to 5.0*                  |

\*It is recommended to perform a Conductivity calibration after performing a reset.

## CALIBRATION

### TEMPERATURE

All Pro30 cables have built-in temperature sensors. Temperature calibration is not required nor is it available.

### CONDUCTIVITY CALIBRATION

Ensure the conductivity sensor is clean and dry before performing a conductivity, specific conductance or salinity calibration.



*It is not necessary to calibrate conductivity, specific conductance and salinity. Calibrating one of these parameters will simultaneously calibrate the others. YSI recommends calibrating specific conductance for greatest ease.*

### CALIBRATING SPECIFIC (SP.) CONDUCTANCE OR CONDUCTIVITY

Note: When calibrating Specific Conductance, the Pro30 uses the factory default values for the Specific Conductance Reference Temperature and the Specific Conductance Temperature Coefficient regardless of what is configured in the System Setup Menu. The default value for the Reference Temperature is 25°C and the default value for the Temperature Coefficient is 1.91%/°C. It is important to note that the Temperature Coefficient of a calibration solution is dependent on the contents of the solution. Therefore, YSI recommends using a traceable calibration solution made of KCl (potassium chloride) when calibrating Specific Conductance since these solutions typically have a Temperature Coefficient of 1.91%/°C. Additionally, be sure to enter the value of the solution as it is listed for 25°C when calibrating Specific Conductance.

1. Fill a clean container (i.e. plastic cup or glass beaker) with fresh, traceable conductivity calibration solution and place the sensor into the solution. The solution must cover the holes of the conductivity sensor that are closest to the cable (figure 7). Ensure the entire conductivity sensor is submerged in the solution or the instrument will read approximately half the expected value. Gently move the probe up and down to remove any air bubbles from the conductivity sensor.

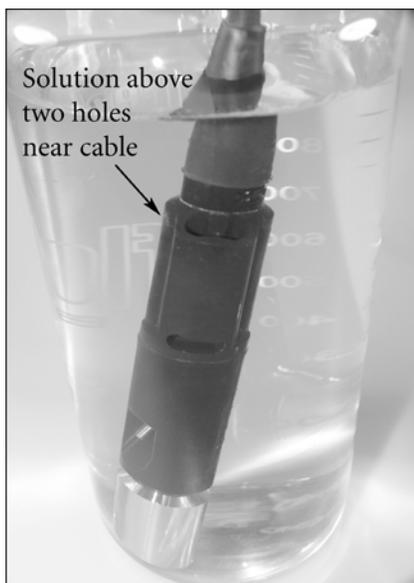


Figure 7, solution above two holes near cable.

2. Turn the instrument on and allow the conductivity and temperature readings to stabilize. Press and hold the Cal key for 3 seconds. Highlight Conductivity and press enter. Next, highlight the desired calibration method, Sp. Conductance or Conductivity, and press enter.
3. Highlight the units you wish to calibrate, either uS/cm or mS/cm, and press enter. 1 mS = 1,000 uS. Next, use the up or down arrow key to adjust the value on the display to match the value of the conductivity calibration solution. If calibrating conductivity, it is necessary to look up the value of the solution at the current temperature and enter that value into the Pro30. Most conductivity solutions are labeled with a value at 25°C. If calibrating specific conductance, enter the value listed for 25°C. Depressing either the up or down arrow key for 5 seconds will move the changing digit one place to the left. The Pro30 will remember the entered calibration value and display it the next time a conductivity calibration is performed.
4. Press enter to complete the calibration. Or, press Cal to cancel the calibration and return to the Run screen.
5. 'Calibration Successful' will display for a few seconds to indicate a successful calibration and then the instrument will return to the Run screen.
6. If the calibration is unsuccessful, an error message will display on the screen. Press the Cal key to exit the calibration error message and return to the Run screen. See the Troubleshooting guide for possible solutions.

---

## CALIBRATING IN SALINITY

---

1. Fill a clean container (i.e. plastic cup or glass beaker) with fresh, traceable salinity calibration solution and place the sensor into the solution. The solution must cover the holes of the conductivity sensor that are closest to the cable (figure 7). Ensure the entire conductivity sensor is submerged in the solution or the instrument will read approximately half the expected value. Gently move the probe up and down to remove any air bubbles from the conductivity sensor.
2. Turn the instrument on and allow the conductivity and temperature readings to stabilize. Press and hold the Cal key for 3 seconds. Highlight Conductivity and press enter. Next, highlight Salinity and press enter.
3. Use the up or down arrow key to adjust the value on the display to match the value of the salinity solution. Depressing either the up or down arrow key for 5 seconds will move the changing digit one place to the left. The Pro30 will remember the entered calibration value and display it the next time a salinity calibration is performed.
4. Press enter to complete the calibration. Or, press Cal to cancel the calibration and return to the Run screen.
5. 'Calibration Successful' will display for a few seconds to indicate a successful calibration and then the instrument will return to the Run screen.
6. If the calibration is unsuccessful, an error message will display on the screen. Press the Cal key to exit the calibration error message and return to the Run screen. See the Troubleshooting guide for possible solutions.

---

## TAKING MEASUREMENTS

---

Before taking measurements, be sure the instrument has been calibrated to ensure the most accurate readings. Place the probe in the sample to be measured and give the probe a quick shake to release any air bubbles. Be sure the conductivity sensor is completely submerged in the sample. The two holes near the cable should be covered by the sample for accurate conductivity readings (figure 7). Allow the temperature readings to stabilize.

---

## SAVING AND VIEWING DATA

---

The Pro30 can store 50 data sets in non-volatile memory for later viewing. A data set includes the values currently on the display, i.e. temperature, dissolved oxygen and two conductivity parameters. Each data point is referenced with a data set number, 01 through 50.

## SAVING DATA



The Pro30 can not communicate to a PC via a Pro Series communications saddle. Connecting the Pro30 to a communication saddle may cause erratic instrument behavior.

From the Run screen, use the up or down arrow keys to highlight the Save box and press enter to save the current readings. The instrument will indicate the data set is saved and display the saved data set's number (figure 8).

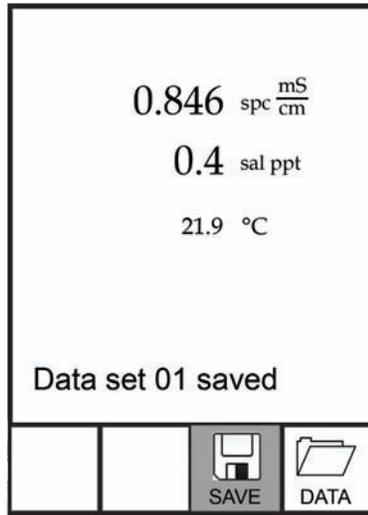


Figure 8, data set saved.

The instrument will display 'Memory Full' if all 50 data sets have been saved and you attempt to save another data set.

## VIEWING AND ERASING SAVED DATA - DATA MODE

Data mode allows you to view and erase saved data. From the Run screen, use the up or down arrow keys to highlight Data and press enter to access Data mode. Note that the function boxes at the bottom of the display are different in Data mode (figure 9).

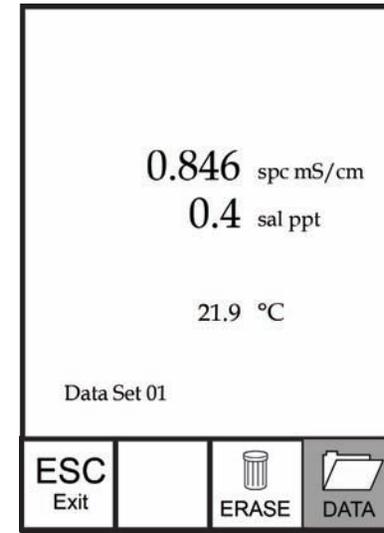


Figure 9, Data mode.

## VIEWING DATA

Once in Data mode, use the up and down arrow keys to view saved data sets in sequential order or press enter to access the bottom functions. After accessing the bottom functions, highlight the Data box and press enter to regain access to viewing data. The data set displayed is indicated by the data set number, 01 through 50.

## ERASING DATA

While viewing saved data, press the enter key to access the function boxes at the bottom of the display. Next, use the up or down arrow keys to highlight Erase, then press enter. The instrument will give you the option to erase one data set or all data sets (figure 10).

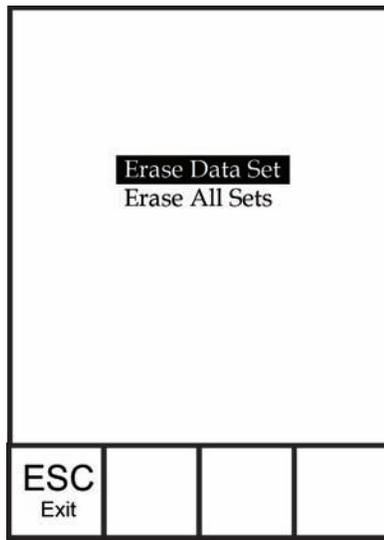


Figure 10, Erase data mode.

Use the up or down arrow key to select Erase Data Set, Erase All Sets or the ESC-Exit function box, then press enter to confirm.

Select ESC-Exit and press enter to exit Erase mode without erasing any data.

Select Erase Data Set and press enter to erase the data set that was displayed before entering Erase mode. For example, if data set 12 was displayed before entering erase mode, and Erase Data Set is selected, Data Set 12 will be erased from memory and the data sets AFTER that number will move up to keep them sequential. For example, if there are 15 records and number 12 is erased then 13 becomes 12, 14 becomes 13, and 15 becomes 14. The instrument will return to Data mode after erasing one data set.

Select Erase All Data Sets and press enter to clear the Pro30 memory and return to Data mode.

---

#### EXITING DATA MODE

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While in Data mode, press enter to access the bottom functions. Next, highlight the ESC-Exit box and press enter to return to the Run screen.

## CARE, MAINTENANCE AND STORAGE

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This section describes the proper procedures for care, maintenance and storage of the instrument. The goal is to maximize their lifetime and minimize downtime associated with improper instrument usage.

### GENERAL MAINTENANCE

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#### GENERAL MAINTENANCE - GASKET

---

The instrument utilizes a gasket as a seal to prevent water from entering the battery compartment. Following the recommended procedures will help keep the instrument functioning properly.

If the gasket and sealing surfaces are not maintained properly, it is possible that water can enter the battery compartment. If water enters this area, it can severely damage the battery terminals causing loss of battery power and corrosion to the battery terminals. Therefore, when the battery compartment lid is removed, the gasket that provides the seal should be carefully inspected for contamination (i.e. debris, grit, etc.) and cleaned with water and mild detergent if necessary.

### SENSOR MAINTENANCE

---

#### SENSOR MAINTENANCE - TEMPERATURE

---

You must keep the temperature sensor free of build up. Other than that, no additional maintenance is required. A toothbrush can be used to scrub the temperature sensor if needed.

---

#### SENSOR MAINTENANCE - CONDUCTIVITY

---

The openings that allow sample access to the conductivity electrodes should be cleaned regularly. The small cleaning brush included in the Maintenance Kit is intended for this purpose. Dip the brush in clean water and insert it into each hole 10 to 12 times. In the event that deposits have formed on the electrodes, it may be necessary to use a mild detergent (laboratory grade soap or bathroom foaming tile cleaner) with the brush. Rinse thoroughly with clean water, then check the response and accuracy of the conductivity cell with a calibration solution.

## SENSOR STORAGE

### SHORT AND LONG TERM STORAGE

For both short and long term storage, the conductivity sensor should be stored clean and dry.

Remove the batteries from the instrument when storing it for long periods of time (>30 days).

Long Term Storage Temperature: -5 to 70°C (23 to 158°F)

## TROUBLESHOOTING

| <i>Symptom</i>  | <i>Possible Solution</i>  |
|---|---|
| Instrument will not turn on, a battery symbol appears, or “Critical Shutdown” displays on the screen.   | <ol style="list-style-type: none"> <li>1. Low battery voltage, replace batteries.</li> <li>2. Batteries installed incorrectly, check battery polarity.</li> <li>3. Return system for service.</li> </ol>  |
| Temperature values display Over or Undr on Run screen.  | <ol style="list-style-type: none"> <li>1. Sample temperature is less than -5° C or more than +55°C. Increase or decrease the sample temperature to bring within the allowable range.</li> <li>2. Contact YSI Tech Support.</li> </ol>   |
| Instrument will not calibrate the Conductivity sensor; instrument displays “Calibration Over”, “Calibration Under”, or “Unstable Reading” during calibration. | <ol style="list-style-type: none"> <li>1. Ensure the conductivity sensor is clean. Follow the cleaning procedures in the Care, Maintenance and Storage section of this manual.</li> <li>2. Verify the calibration solution is above the two holes near the cable, see figure 8.</li> <li>3. Verify the calibration solution is not expired or contaminated. Try a new bottle of solution.</li> <li>4. Ensure you are entering in the correct value for the solution according to the measurement units. 1 mS = 1,000 uS.</li> <li>5. Allow sufficient stabilization time for conductivity and temperature AND wait at least 3 seconds before confirming a calibration.</li> <li>6. Contact YSI Tech Support.</li> </ol> |

| <i>Symptom</i>  | <i>Possible Solution</i>   |
|---|--|
| Conductivity readings are inaccurate.                   | <ol style="list-style-type: none"> <li>1. Ensure the conductivity sensor is clean. Follow the cleaning procedures in the Care, Maintenance and Storage section of this manual.</li> <li>2. Verify the sample is above the two holes near the cable, see figure 8.</li> <li>3. Verify calibration.</li> <li>4. Verify temperature readings are accurate.</li> <li>5. Verify the correct units are setup in the System Setup menu, i.e. uS vs mS and Conductivity vs. Specific Conductance.</li> <li>6. Contact YSI Tech Support.</li> </ol> |
| Conductivity values display Over or Undr on Run screen. | <ol style="list-style-type: none"> <li>1. Ensure the conductivity sensor is clean. Follow the cleaning procedures in the Care, Maintenance and Storage section of this manual.</li> <li>2. Verify the sample is above the two holes near the cable, see figure 8</li> <li>3. Verify calibration.</li> <li>4. Verify temperature readings are accurate.</li> <li>5. Sample conductivity is outside the measurement range of the instrument, i.e. 0-200 mS.</li> <li>6. Contact YSI Tech Support.</li> </ol>                                 |

## SPECIFICATIONS

These specifications represent typical performance and are subject to change without notice. For the latest product specification information, please visit YSI's website at [www.ysi.com](http://www.ysi.com) or contact YSI Tech Support.

| <i>Parameter</i>             | <i>Range</i>   | <i>Resolution</i>  | <i>Accuracy</i>   |
|------------------------------|--|--|---|
| Temperature                  | -5 to 55°C   | 0.1°C  | ± 0.2°C   |
| Conductivity                 | 0-500 uS/cm<br>0-5 mS/cm<br>0-50 mS/cm<br>0-200 mS/cm (auto ranging) | 0.0001 to 0.1 mS/cm;<br>0.1 to 0 uS/cm (range dependent) | Instrument only: ± 0.5% of the reading or 1 uS/cm, whichever is greater.<br>Instrument with 1 or 4 meter cables: ± 1.0% of the reading or 1 uS/cm, whichever is greater.<br>Instrument with 10, 20, or 30 meter cables: ± 2.0% of the reading or 1 uS/cm, whichever is greater. |
| Salinity                     | 0 to 70 ppt  | 0.1 ppt  | ± 1.0% of the reading or ± 0.1 ppt, whichever is greater.   |
| Total Dissolved Solids (TDS) | 0 to 100 g/L.<br>TDS Constant range: 0.3 to 1.00 (0.65 default)      | 0.0001 to 0.1 g/L (range dependent)                      | Dependent on accuracy of temperature, conductivity and TDS Constant.  |

## ACCESSORIES / PART NUMBERS

| <i>Part Number</i>            | <i>Description</i>  |
|-------------------------------|---|
| 6050030                       | Pro30 Instrument  |
| 60530-1, -4, -10, -20, or -30 | 1, 4, 10, 20, 30-meter cable assembly*                              |
| 603077                        | Flow cell   |
| 603056                        | Flow cell mounting spike  |
| 603075                        | Carrying case, soft-sided   |
| 603074                        | Carrying case, hard-sided   |
| 603069                        | Belt clip   |
| 063517                        | Ultra clamp for instrument  |
| 063507                        | Tripod for instrument   |
| 603062                        | Cable management kit, included with all cables longer than 1 meter. |
| 605978                        | Cable weight, 4.9 oz, stackable                                     |
| 603070                        | Shoulder strap  |
| 060907                        | Conductivity Calibration Solution, 1,000 µS/cm. 1 box of 8 pints.   |
| 060911                        | Conductivity Calibration Solution, 10,000 µS/cm. 1 box of 8 pints.  |
| 060660                        | Conductivity Calibration Solution, 50,000 µS/cm. 1 box of 8 pints.  |
| 065274                        | Conductivity Calibration Solution, 100,000 µS/cm. 1 box of 8 pints. |

\*All cables include a temperature and conductivity sensor.

# DECLARATION OF CONFORMITY

The undersigned hereby declares on behalf of the named manufacturer under our sole responsibility that the listed product conforms to the requirements for the listed European Council Directive(s) and carries the CE mark accordingly.

|                                     |  |
|-------------------------------------|--|
| <i>Manufacturer:</i>                | YSI Incorporated<br>1725 Brannum Lane<br>Yellow Springs, OH 45387<br>USA   |
| <i>Product Name:</i>                | Pro30 Water Quality Instrument   |
| <i>Model Numbers</i>                |  |
| <i>Instrument/Accessory:</i>        | Pro30 (6050030)  |
| <i>Probe/Cable Assemblies:</i>      | 60530-1, -4, -10, -20, and -30   |
| <i>Conforms to the following:</i>   |  |
| <i>Directives:</i>                  | IEC 61326-1:2005<br>RoHS 2002/95/EC<br>WEEE 2002/96/EC<br>IP-67 Protection per ANSI/IEC 60529-2004   |
| <i>Harmonized Standards:</i>        | <ul style="list-style-type: none"> <li>EN61326-1:2006 (IEC 61326-1:2005) Basic Immunity</li> </ul>   |
| <i>Supplementary Information:</i>   | All performance met the operation criteria as follows:<br>1. ESD, IEC 61000-4-2:2001, Performance Criterion B<br>2. Radiated Immunity, IEC 61000-4-3, Performance Criterion A<br>3. Electrical Fast Transient (EFT), IEC 61000-4-4:2004, +Corr. 1:2006 + Corr. 2:2007, Performance Criterion B<br>4. Radio Frequency, Continuous Conducted Immunity, IEC61000-4-6, Performance Criterion A<br>5. Radiated Emissions, EN 61326-1:2006 (IEC61326-1:2005) Class B |
| <i>Authorized EU Representative</i> | YSI Hydrodata Ltd<br>Unit 2 Focal Point, Lacerta Court, Works Road<br>Letchworth, Hertfordshire, SG6 1FJ UK  |



Signed: Lisa M. Abel  
Title: Director of Quality

Date: 27 June 2011

# RECYCLING

YSI is committed to reducing the environmental footprint in the course of doing business. Even though materials reduction is the ultimate goal, we know there must be a concerted effort to responsibly deal with materials after they've served a long, productive life-cycle. YSI's recycling program ensures that old equipment is processed in an environmentally friendly way, reducing the amount of materials going to landfills.

- Printed Circuit Boards are sent to facilities that process and reclaim as much material for recycling as possible.
- Plastics enter a material recycling process and are not incinerated or sent to landfills.
- Batteries are removed and sent to battery recyclers for dedicated metals.

When the time comes for you to recycle, follow the easy steps outlined at [www.yisi.com](http://www.yisi.com).

## BATTERY DISPOSAL

The Pro30 is powered by alkaline batteries which the user must remove and dispose of when the batteries no longer power the instrument. Disposal requirements vary by country and region, and users are expected to understand and follow the battery disposal requirements for their specific locale.

# CONTACT INFORMATION

---

## ORDERING AND TECHNICAL SUPPORT

---

Telephone: 800 897 4151 (USA)  
+1 937 767 7241 (Globally)  
Monday through Friday, 8:00 AM to 5:00 ET

Fax: +1 937 767 9353 (orders)  
+1 937 767 1058 (technical support)

Email: environmental@ysi.com  
Mail: YSI Incorporated  
1725 Brannum Lane  
Yellow Springs, OH 45387 USA

Internet: www.ysi.com

When placing an order please have the following available:

- 1.) YSI account number (if available)
- 2.) Name and phone number
- 3.) Purchase Order or Credit Card number
- 4.) Model Number or brief description
- 5.) Billing and shipping addresses
- 6.) Quantity

## SERVICE INFORMATION

---

YSI has authorized service centers throughout the United States and Internationally. For the nearest service center information, please visit [www.ysi.com](http://www.ysi.com) and click 'Support' or contact YSI Technical Support directly at 800-897-4151 (+1 937-767-7241).

When returning a product for service, include the Product Return form with cleaning certification. The form must be completely filled out for a YSI Service Center to accept the instrument for service. The form may be downloaded from [www.ysi.com](http://www.ysi.com) by clicking on the 'Support'.

Item # 606082  
Rev A  
Drawing # A606082  
July 2011

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DOC022.53.80451

## Pocket Colorimeter II

User Manual

04/2014, Edition 1

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## Section 1 Specifications

Specifications are subject to change without notice.

| Specification           | Details   |
|-------------------------|---|
| Dimensions (W x D x H)  | 6.1 x 3.2 x 15.2 cm (2.4 x 1.25 x 6 in.)  |
| Enclosure               | IP67, waterproof at 1 m (3.3 ft) for 30 minutes (battery compartment not included). Keep out of direct sunlight.                        |
| Light source            | Light emitting diode (LED)  |
| Detector                | Silicon photodiode  |
| Display                 | LCD with backlight  |
| Weight                  | 0.2 kg (0.43 lb)  |
| Pollution degree        | 2   |
| Installation category   | 1   |
| Protection class        | 3   |
| Power requirements      | 4 AAA batteries; approximate life of 2000 tests (use of backlight decreases this number)<br>Rechargeable batteries are not recommended. |
| Operating environment   | 0 to 50 °C (32 to 122 °F), 0 to 90% relative humidity non-condensing  |
| Storage temperature     | -20 to 55 °C (-7.6 to 131 °F)   |
| Photometric precision   | ± 0.0015 Abs  |
| Wavelength              | Fixed wavelength ±2 nm, different for each model  |
| Filter bandwidth        | 15 nm   |
| Absorbance range        | 0 to 2.5 Abs  |
| Sample cell path length | 1 cm (5–10 mL), 25 mm (10 mL)   |
| Data storage            | Last 10 measurements  |
| Certifications          | CE mark   |
| Warranty                | 2 years   |

## Section 2 General information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

### 2.1 Safety information

#### NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

#### 2.1.1 Use of hazard information

##### ▲ DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

##### ▲ WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

##### ▲ CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

## General information

### NOTICE

Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

#### 2.1.2 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

|   |   |
|---|---|
|  | This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.   |
|  | Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer for disposal at no charge to the user. |

#### 2.1.3 Certification

##### Canadian Radio Interference-Causing Equipment Regulation, IECS-003, Class A:

Supporting test records reside with the manufacturer.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de classe A répond à toutes les exigences de la réglementation canadienne sur les équipements provoquant des interférences.

##### FCC Part 15, Class "A" Limits

Supporting test records reside with the manufacturer. The device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. The equipment may not cause harmful interference.
2. The equipment must accept any interference received, including interference that may cause undesired operation.

## General information

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their expense. The following techniques can be used to reduce interference problems:

1. Move the equipment away from the device receiving the interference.
2. Reposition the receiving antenna for the device receiving the interference.
3. Try combinations of the above.

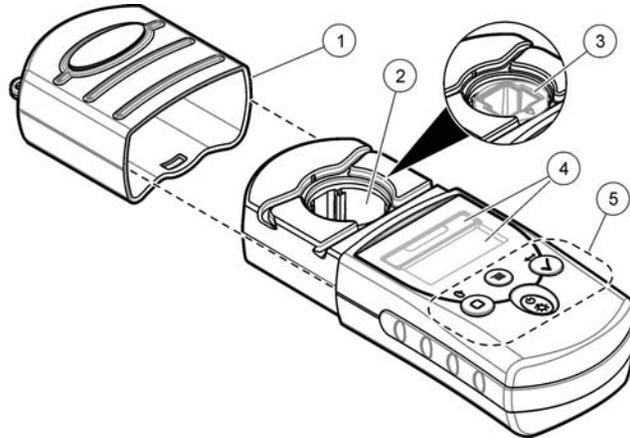
## 2.2 Product overview

This instrument is a portable filter photometer used for testing water. Refer to [Figure 1](#). This instrument is configured at the factory to measure one or two specific parameters. This instrument is calibrated at the factory. No user calibration is necessary.

**Note:** This instrument has not been evaluated to measure chlorine and chloramines in medical applications in the United States.

## General information

Figure 1 Instrument overview



|                  |   |          |
|------------------|---|----------|
| 1 Instrument cap | 3 Cell holder with 1-cm cell adapter <sup>1</sup> | 5 Keypad |
| 2 Cell holder    | 4 Display   |          |

<sup>1</sup> Factory installed in some models

## Section 3 Startup

### 3.1 Install the batteries

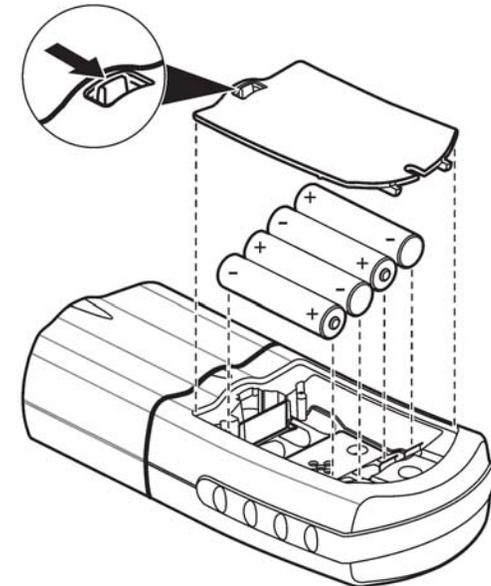
#### ⚠ WARNING



Explosion hazard. Incorrect battery installation can cause the release of explosive gases. Be sure that the batteries are of the same approved chemical type and are inserted in the correct orientation. Do not mix new and used batteries.

Install the batteries as shown in [Figure 2](#).

Figure 2 Install the batteries



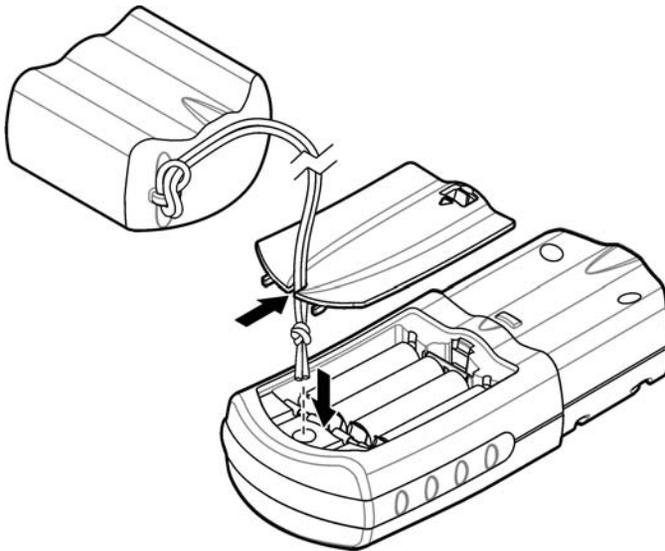
## Startup

---

### 3.2 Install the cap cord

Attach the cap cord to prevent loss of the instrument cap. Refer to [Figure 3](#).

**Figure 3** Install the cap cord



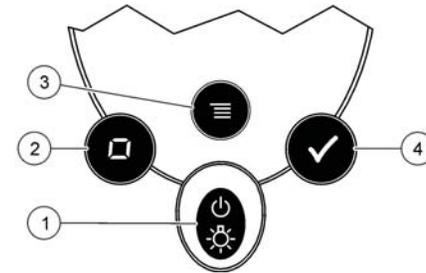
## Section 4 User interface and navigation

---

### 4.1 Keypad description

[Figure 4](#) shows the keypad and gives the key functions.

**Figure 4** Keypad



|   |   |
|---|---|
| <b>1 Power/Backlight key:</b> Sets the power to on and off. Push and hold for 1 second to set the backlight to on or off. | <b>3 Menu key:</b> Enters and goes out of menu mode.  |
| <b>2 Zero/Scroll key:</b> Sets the instrument to zero, scrolls through menu options and numbers                           | <b>4 Read/Enter key:</b> Starts a sample measurement, selects a menu option, moves the cursor to the next digit |

### 4.2 Display description

[Figure 5](#) shows the values and icons shown on the display.

## User interface and navigation

Figure 5 Display



|  |  |
|--|--|
| 1 <b>Numeric display:</b> Measured value or menu options | 4 <b>Menu icon:</b> The instrument is in menu mode.  |
| 2 <b>Range icon:</b> Selected range or parameter         | 5 <b>Calibration adjusted icon:</b> The factory default calibration was adjusted or a user-entered calibration curve was entered. Refer to the expanded user manual on the manufacturer's website. |
| 3 <b>Range value:</b> Range(s) or parameters             | 6 <b>Low battery icon:</b> Battery level is 10%. Flashes when the battery level is too low to complete measurements.   |

## Section 5 Operation

### 5.1 Configure the instrument

1. Push .
2. Push  to scroll through the menu options. Push  to select an option.

| Option       | Description  |
|--------------|--|
| <b>SEL</b>   | Sets the measurement range or parameter. Push  to toggle between the measurement ranges or parameters.  |
| <b>00:00</b> | Sets the time in 24-hour format (hh:mm). Push  to change the time. Push  to change the first digit, then  to go to the next digit.  |
| <b>rCL</b>   | Shows the last 10 measurements recorded. Push  to show the recorded measurements (01—most recent measurement, 10—oldest measurement). Push  to scroll through the measurements. To select a measurement by number, push  to select the number and then  . Push  to go out of this option. |
| <b>SCA</b>   | Refer to <a href="#">Standard calibration adjust</a> on page 17.   |

3. Push  to go back to measurement mode.

### 5.2 Run a test

#### ⚠ WARNING



Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

The basic measurement steps necessary to run a test follow. Refer to the applicable method to run a specific test.

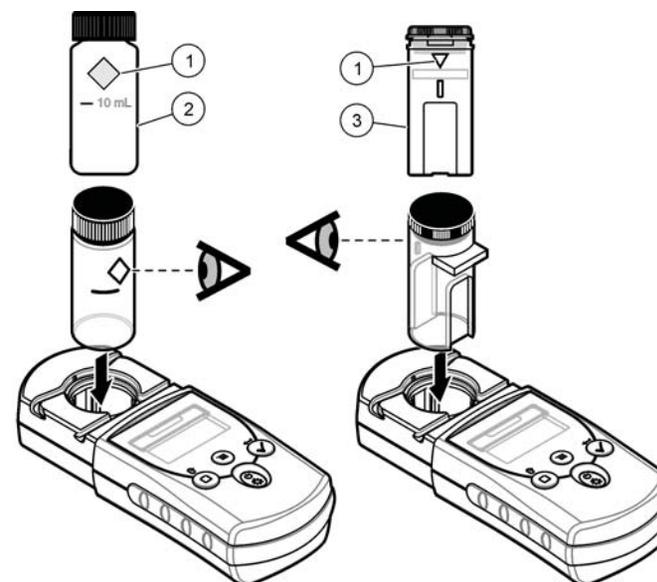
1. Select the applicable measurement range or parameter. Refer to [Configure the instrument](#) on page 13.
2. Prepare the blank according to the method document. Make sure to use the correct sample cell size. Rinse the sample cell and cap with the blank before the sample cell is filled.

## Operation

3. Close the sample cell and clean the optical faces of the sample cell with a lint-free cloth.
4. Insert the blank sample cell into the cell holder. Make sure to install the blank sample cell in the correct and consistent orientation so that the results are more repeatable and precise. Refer to [Figure 6](#).
5. Install the instrument cap over the cell holder. Refer to [Figure 7](#).
6. Push  to set the instrument zero. The display shows "0.000", or the degree of resolution that was previously selected.
7. Prepare the sample. Rinse the sample cell and cap with the sample three times before the sample cell is filled. Add reagents as specified by the method document.
8. Close the sample cell and clean the optical surfaces of the cell with a lint-free cloth.
9. Insert the sample into the cell holder. Make sure to install the sample cell in the correct and consistent orientation so that the results are more repeatable and precise. Refer to [Figure 6](#).
10. Install the instrument cap over the cell holder. Refer to [Figure 7](#).
11. Push . The display shows the results in concentration units or absorbance.  
*Note: The result flashes if the result is less or more than the instrument range.*
12. Remove the prepared sample from the cell holder.
13. Immediately empty and rinse the sample cell. Rinse the sample cell and cap three times with deionized water.

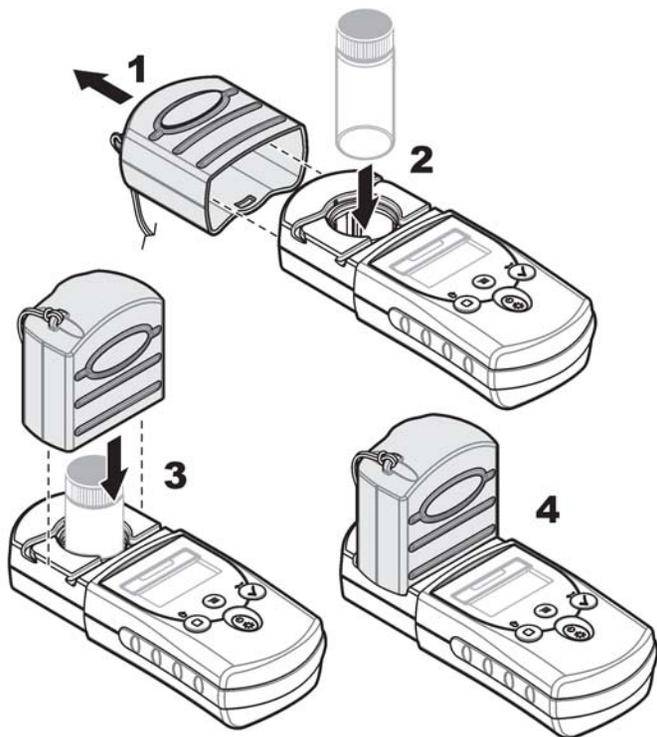
## Operation

Figure 6 Sample cell orientation



|                    |                              |                             |
|--------------------|------------------------------|-----------------------------|
| 1 Orientation mark | 2 Sample cell, 25-mm (10 mL) | 3 Sample cell, 1-cm (10 mL) |
|--------------------|------------------------------|-----------------------------|

Figure 7 Install the instrument cap over the cell holder



### 5.3 Show the recorded measurements

Refer to the "rCL" option in [Configure the instrument](#) on page 13.

## 5.4 Standard calibration adjust

Use the standard calibration adjust (SCA) option when a calibration must be adjusted to meet regulatory requirements. The factory calibration is adjusted slightly with the standard calibration adjust (SCA) option so that the instrument shows the expected value of the standard solution. The adjusted calibration is then used for all test results. This adjustment can increase the test accuracy when there are slight variations in the reagents or instruments.

**Note:** For instruments with factory-calibrated ranges or methods, the standard calibration adjust (SCA) feature is disabled when a user-entered method is entered into the instrument. To set SCA back to on, set the instrument to the factory default calibration. Refer to [Set to the factory default calibration](#) on page 22.

### 5.4.1 Adjust the factory calibration with a standard

1. Complete the test procedure for the range to calibrate. For the sample, use the standard solution concentration given in the test procedure documentation.

**Note:** If a standard solution concentration is not given in the test procedure documentation, a different known standard can be used.

2. When the test procedure is completed, push .
3. Push  until "SCA" shows, then push . The display shows the standard calibration adjust value.
4. If a different known standard is used, enter the value of the standard:
  - a. Push  until "Edit" shows, then push .
  - b. Push  to enter the value of the standard. Push  to go to the next digit.
5. Push  to add the standard calibration adjust value to the factory calibration curve. The calibration adjusted icon shows on the display. Refer to [Figure 5](#) on page 12.

### 5.4.2 Set the standard calibration adjust to off

To use the factory default calibration again, set standard calibration adjust (SCA) to off.

1. Push .
2. Push  until "SCA" shows, then push .
3. Push  until "OFF" shows, then push .

**Note:** To set the SCA function to on again, calibrate with a standard.

## 5.5 User-entered calibration

This instrument accepts a user-prepared calibration curve. The calibration curve can be from 0 to 2.5 absorbance. Make sure that the calibration curve includes standard values that are less and more than the range of interest.

The instrument range will be the same as the calibration range. For example, when the standards that are used are 1.00, 2.00 and 4.00. The instrument range is 1.00 to 4.00.

There are two options to enter a user calibration curve:

- **Enter a calibration curve with standards**—The standard solution values are entered with the keypad and the absorbance values are measured.
- **Enter a calibration curve with the keypad**—The standard solution values and absorbance values are entered with the keypad.

**Note:** If the instrument is set to off or the instrument power is removed before a user-entered calibration curve is completed, the calibration curve is not saved. The instrument automatically switches off in user-entered calibration entry mode after 60 minutes of no activity. User-entered calibrations are completed when the user goes out of calibration (cal) mode or edit mode.

### 5.5.1 Channel restrictions

A user-entered calibration curve can be entered into any channel that does not contain a factory-programmed curve. These channels have the label:

- "abs" on the instruments that have a single factory calibration

- "1" and "2" on the single wavelength instruments that are not calibrated

Any chemistry that can be done at the instrument wavelength can contain a user-entered calibration in these channels.

### 5.5.2 Enter a calibration curve with standards

**Note:** Deionized water can be used for the blank unless the sample is significantly more turbid or has more color than deionized water.

1. Set the instrument to the range to calibrate. Refer to [Configure the instrument](#) on page 13.
  2. Prepare the blank and the reacted standard solution. Refer to the test procedure. Let the color fully develop.
  3. Set the instrument to zero.
    - a. Insert the blank sample cell in the cell holder.
    - b. Install the instrument cap over the cell holder.
    - c. Push . The display shows "- - -", then "0.000".
    - d. Remove the instrument cap.
    - e. Remove the sample cell from the cell holder.
  4. Push and hold  until "USER" and then "CAL" shows, then push .
- Note:** If "USER" and "CAL" do not show, the factory calibration cannot be changed on the selected range.
5. If "RES" shows on the display, set the resolution.
    - a. Push . The resolution setting (decimal placement) shows.
    - b. To change the resolution, push , then . Push  to save the change.
    - c. To not change the resolution, push .

**Note:** "RES" does not show on the display of factory-calibrated instruments because the resolution cannot be changed. Only instruments that are not factory calibrated or have "abs" as one of the two ranges show "RES" on the display.

## Operation

---

6. When "S0" shows on the display, push ✓. Push  to enter the blank value, then push ✓.  
*Note: Push ✓ to go to the next digit.*
7. When "A0" shows on the display, measure the absorbance of the blank.
  - a. Insert the blank sample cell in the cell holder.
  - b. Install the instrument cap over the cell holder.
  - c. Push ✓. The display shows the absorbance value for "S0".
  - d. Remove the sample cell from the cell holder.
8. Push  to show "S1".
9. When "S1" shows on the display, push ✓. Push  to enter the first standard value, then push ✓.  
*Note: Push ✓ to enter the next digit.*
10. When "A1" shows on the display, measure the absorbance of the reacted standard solution.
  - a. Insert the reacted standard sample cell in the cell holder.
  - b. Install the instrument cap over the cell holder.
  - c. Push ✓. The display shows the absorbance value for "S1".
  - d. Remove the sample cell from the cell holder.
11. The calibration is completed with two calibration points. If additional standards are necessary for calibration:
  - a. Push  until "Add" shows, then push ✓.
  - b. Do steps 9–10 again to enter more standards.
12. Push  two times to go back to measurement mode.

### 5.5.3 Enter a calibration curve with the keypad

At least two data pairs are necessary to enter a user-prepared calibration curve. A concentration value and the absorbance value for the given concentration is necessary for each data pair. A maximum of 10 data pairs can be entered.

*Note: This procedure can also be used to change the data pairs in a user-entered calibration curve or factory calibration curve.*

## Operation

---

1. Set the instrument to the range to calibrate. Refer to [Configure the instrument](#) on page 13.
2. Push and hold  until "USER" and then "CAL" shows, then push ✓.  
*Note: If "USER" and "CAL" do not show, the factory calibration cannot be changed on the selected range.*
3. Push  until "EDIT" shows, then push ✓.
4. If "RES" shows on the display, set the resolution.
  - a. Push . The resolution setting (decimal placement) shows.
  - b. To change the resolution, push ✓, then . Push ✓ to save the change.
  - c. To not change the resolution, push .  
*Note: "RES" does not show on the display of factory-calibrated instruments because the resolution cannot be changed. Only instruments that are not factory calibrated or have "abs" as one of the two ranges show "RES" on the display.*
5. When "S0" shows on the display, push ✓. Push  to enter the concentration value of the first data pair, then push ✓.  
*Note: Push ✓ to go to the next digit.*
6. When "A0" shows on the display, push ✓. Push  to enter the absorbance value of the first data pair, then push ✓. "S1" shows on the display.
7. Do steps 5–6 again to enter the second data pair (S1 and A1).
8. The calibration is completed with two data pairs. If additional data pairs are necessary for calibration:
  - a. When "Add" shows, push ✓.
  - b. Do steps 5–6 again to enter more data pairs.
9. Push  two times to go back to measurement mode.

### 5.5.4 Remove a calibration point

To remove a calibration point from a user-entered calibration curve:

## Operation

1. Set the instrument to the range to calibrate. Refer to [Configure the instrument](#) on page 13.
2. Push and hold  until "USER" and then "CAL" shows.  
**Note:** If "USER" and "CAL" do not show, the factory calibration cannot be changed on the selected range.
3. Push  until "EDIT" shows, then push .
4. Push  until the calibration point to remove shows (i.e., S0 or S1), then push .
5. Push  until "dEL" shows, then push .
6. Push  two times to go back to measurement mode.

### 5.5.5 Set to the factory default calibration

1. Set the instrument to the applicable range. Refer to [Configure the instrument](#) on page 13.
2. Push and hold  until "USER" and then "CAL" shows.  
**Note:** If "USER" and "CAL" do not show, the factory calibration cannot be changed on the selected range.
3. Push  until "dFL" shows, then push .

## Section 6 Maintenance

### ⚠ CAUTION



Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

### NOTICE

Do not disassemble the instrument for maintenance. If the internal components must be cleaned or repaired, contact the manufacturer.

### 6.1 Clean the instrument

Clean the exterior of the instrument with a moist cloth and a mild soap solution and then wipe the instrument dry.

### 6.2 Clean the sample cells

#### ⚠ CAUTION



Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

#### ⚠ CAUTION



Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

Most laboratory detergents are used at recommended concentrations. Neutral detergents, such as Liquinox, are safer to use when regular cleaning is necessary. To decrease the cleaning times, increase the temperature or use an ultrasonic bath. To complete the cleaning, rinse a few times with deionized water and then let the sample cell air dry. Sample cells may also be cleaned with acid, followed by a thorough rinse with deionized water.

**Note:** Always use acid to clean sample cells that were used for low-level metal tests.

## Maintenance

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Special cleaning methods are necessary for individual procedures. When a brush is used to clean sample cells, take extra care to avoid scratches on the interior surfaces of the sample cells.

### 6.3 Replace the batteries

Replace the batteries when the battery power level is low. Refer to [Install the batteries](#) on page 9.

## Section 7 Troubleshooting

---

| Error | Description                      | Solution  |
|-------|----------------------------------|---|
| E-0   | No zero                          | In user calibration mode, a standard solution was measured before the instrument zero was set. Measure a blank solution to set the instrument to zero.  |
| E-1   | Ambient light error <sup>1</sup> | There is ambient light in the cell holder. Make sure that the instrument cap is fully installed over the cell holder.   |
| E-2   | LED error <sup>1</sup>           | The LED (light source) is out of regulation. Replace the batteries. Make sure that the LED in the cell holder comes on when ✓ or  is pushed.   |
| E-3   | Standard adjust error            | <ul style="list-style-type: none"><li>• The measured value of the standard solution is more than the adjustment limits. Prepare a fresh standard.</li><li>• The standard solution is not within the concentration range that can be used for standard calibration adjust. Prepare a standard with a value at or near the recommended concentrations given in the procedure.</li><li>• Make sure that the concentration of the standard solution is entered correctly.</li></ul> |
| E-6   | Abs error                        | The absorbance value is not correct or the user-entered calibration curve has fewer than two points. Enter or measure the absorbance value again.   |
| E-7   | Standard value error             | The standard solution concentration is equal to another standard solution concentration that is already entered in the user-entered calibration curve. Enter the correct standard concentration.  |
| E-9   | Flash error                      | The instrument is not able to save data.  |

## Troubleshooting

| Error           | Description   | Solution  |
|-----------------|---|---|
| Reading flashes | The reading is more or less than the instrument range. <sup>2</sup> | If the reading is less than the instrument range, make sure that the instrument cap is fully installed over the cell holder. Measure a blank. If the blank reading is not zero, set the instrument to zero again. |
|                 |   | If the reading is more than the instrument range, identify if there is a light blockage in the cell holder. Dilute the sample. Do the test again.   |
|                 |   | For factory-calibrated programs, the maximum and minimum values always equal the factory-calibrated values and cannot be changed.   |

<sup>1</sup> When an E-1 or E-2 error occurs on a measurement, the display shows “\_.”. The decimal place depends on the chemistry. If the E-1 or E-2 error occurs while the instrument is set to zero, set the instrument to zero again.

<sup>2</sup> The flashing value will be 10% over the upper test range limit.

## Section 8 Replacement parts

### ⚠ WARNING



Personal injury hazard. Use of non-approved parts may cause personal injury, damage to the instrument or equipment malfunction. The replacement parts in this section are approved by the manufacturer.

**Note:** Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.

### Replacement parts

| Description                           | Quantity | Item no. |
|---------------------------------------|----------|----------|
| AAA batteries, alkaline               | 4/pkg    | 4674300  |
| Cap cord                              | 1        | 5955900  |
| Instrument cap                        | 1        | 5954800  |
| Sample cell, 25 mm (10 mL), with caps | 6/pkg    | 2427606  |
| Sample cell, 1 cm (10 mL), with caps  | 2/pkg    | 4864302  |

# Chlorine, Free and Total, High Range

DOC316.53.01449

USEPA DPD Method<sup>1</sup>

Method DPD

0.1 to 8.0 mg/L Cl<sub>2</sub>

Powder Pillows

**Scope and application:** For testing residual chlorine and chloramines in water, wastewater, estuary water and seawater. USEPA-accepted for reporting for drinking and wastewater analyses.<sup>2</sup> This product has not been evaluated to test for chlorine and chloramines in medical applications in the United States.

<sup>1</sup> Adapted from Standard Methods for the Examination of Water and Wastewater.

<sup>2</sup> Procedure is equivalent to USEPA and Standard Method 4500-Cl G for drinking water and wastewater analysis. Adapted from Hach Methods 8021 and 8167.



## Test preparation

### Before starting

If the chlorine concentration is typically less than 2 mg/L, use the low range (LR) procedure.

Analyze the samples immediately. The samples cannot be preserved for later analysis.

Always do tests in sample cells. Do not put the instrument in the sample or pour the sample into the cell holder.

Make sure that the sample cells are clean and there are no scratches where the light passes through them.

Rinse the sample cell and cap with the sample three times before the sample cell is filled.

Make sure that there are no fingerprints or liquid on the external surface of the sample cells. Wipe with a lint-free cloth before measurement.

Cold waters can cause condensation on the sample cell or bubbles in the sample cell during color development. Examine the sample cell for condensation or bubbles. Remove condensation with a lint-free cloth. Invert the sample cell to remove bubbles.

High range (HR) free chlorine determinations are subject to variable levels of interferences from monochloramine. Refer to [Interferences](#) on page 4.

Install the instrument cap over the cell holder before ZERO or READ is pushed.

Do not use the same sample cells for free and total chlorine. If trace iodide from the total chlorine reagent is carried over into the free chlorine determination, monochloramine will interfere. It is best to use separate, dedicated sample cells for free and total chlorine measurements.

If the test result is over-range, or if the sample temporarily turns yellow after the reagent addition, dilute the sample with a known volume of high quality, chlorine demand-free water and do the test again. Some loss of chlorine may occur due to the dilution. Multiply the result by the dilution factor. Additional methods are available to measure chlorine without dilution.

After the test, immediately empty and rinse the sample cell. Rinse the sample cell and cap three times with deionized water.

For the best results, measure the reagent blank value for each new lot of reagent. Replace the sample with deionized water in the test procedure to determine the reagent blank value. Subtract the reagent blank value from the sample results.

Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

Dispose of reacted solutions according to local, state and federal regulations. Refer to the Safety Data Sheets for disposal information for unused reagents. Refer to the environmental, health and safety staff for your facility and/or local regulatory agencies for further disposal information.

The SwifTest Dispenser for Free Chlorine or Total Chlorine can be used in place of the powder pillow in the test procedures. One dispensation is equal to one powder pillow for 10-mL samples.

## Items to collect

| Description  | Quantity |
|--|----------|
| <b>Chlorine, Free:</b> DPD Free Chlorine Reagent Powder Pillows, 10-mL   | 2        |
| <b>Chlorine, Total:</b> DPD Total Chlorine Reagent Powder Pillows, 10-mL | 2        |
| Sample cells, 1-cm/10-mL   | 2        |

Refer to [Consumables and replacement items](#) on page 6 for order information.

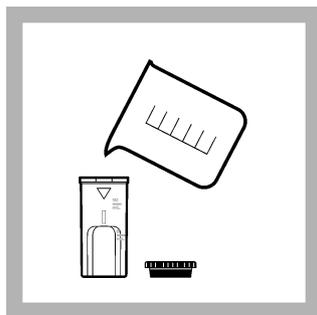
## Sample collection

- Analyze the samples immediately. The samples cannot be preserved for later analysis.
- Chlorine is a strong oxidizing agent and is unstable in natural waters. Chlorine reacts quickly with various inorganic compounds and more slowly with organic compounds. Many factors, including reactant concentrations, sunlight, pH, temperature and salinity influence the decomposition of chlorine in water.
- Collect samples in clean glass bottles. Do not use plastic containers because these can have a large chlorine demand.
- Pretreat glass sample containers to remove chlorine demand. Soak the containers in a weak bleach solution (1 mL commercial bleach to 1 liter of deionized water) for at least 1 hour. Rinse fully with deionized or distilled water. If sample containers are rinsed fully with deionized or distilled water after use, only occasional pretreatment is necessary.
- Make sure to get a representative sample. If the sample is taken from a spigot or faucet, let the water flow for at least 5 minutes. Let the container overflow with the sample several times and then put the cap on the sample container so that there is no headspace (air) above the sample.

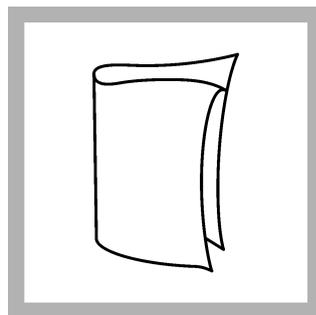
## Powder pillow procedure



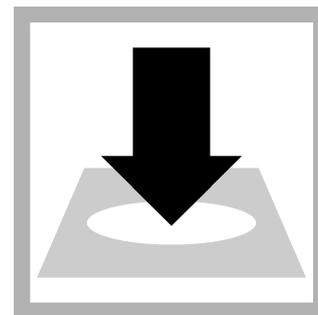
**1.** Set the instrument to high range (HR).  
For DR300, push the up arrow button. For PCII, push the menu button, checkmark button, then the menu button again.



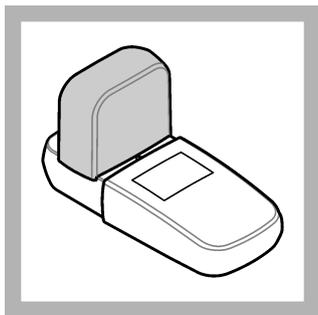
**2. Prepare the blank:**  
Rinse a 1-cm/10-mL sample cell and cap three times with sample. Fill the sample cell to the 5-mL mark with sample. Close the sample cell.



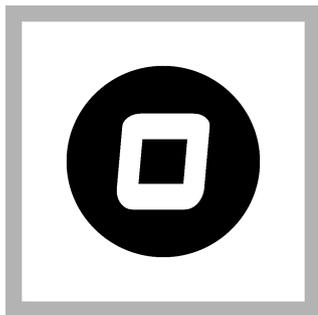
**3.** Clean the blank sample cell.



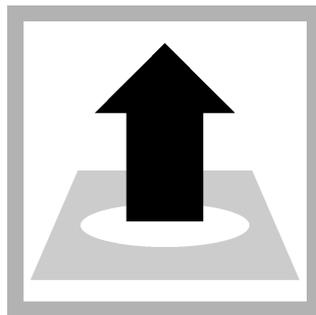
**4.** Insert the blank into the cell holder. Point the triangle mark on the sample cell away from the keypad.



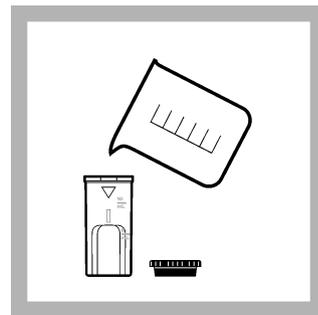
5. Install the instrument cap over the cell holder.



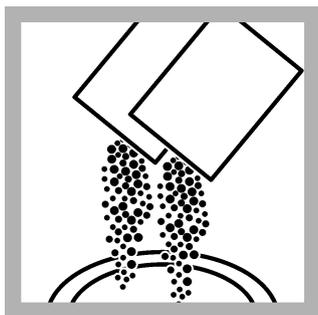
6. Push **ZERO**. The display shows "0.0".



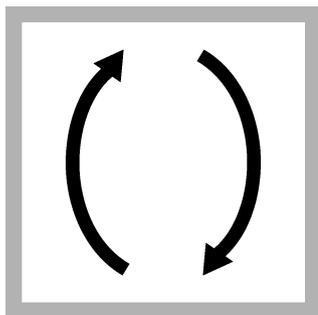
7. Remove the sample cell from the cell holder.



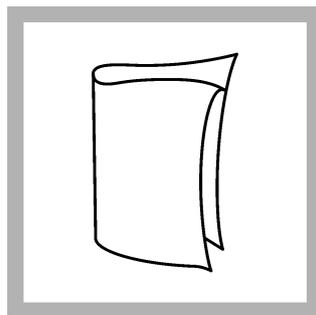
8. **Prepare the sample:** Rinse a second 1-cm/10-mL sample cell and cap three times with sample. Fill the sample cell to the 5-mL mark with sample.



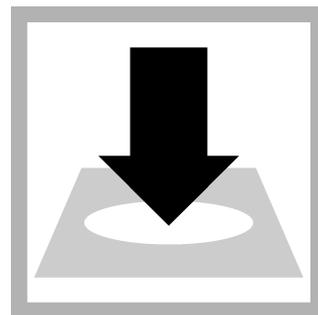
9. Add two 10-mL DPD Free Chlorine Reagent Powder Pillows or two 10-mL DPD Total Chlorine Reagent Powder Pillows to the second sample cell.



10. Close the sample cell. Invert the sample cell for about **20 seconds** to dissolve the reagent. Undissolved powder will not affect accuracy. A pink color will show if chlorine is in the sample.



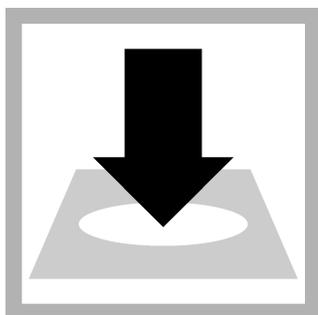
11. Clean the prepared sample cell.



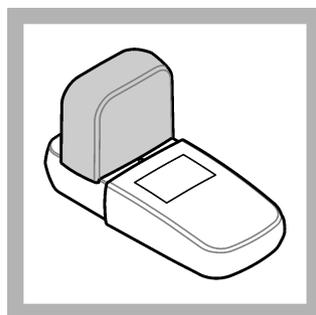
12. **Free chlorine measurement:** Within 1 minute of the reagent addition, insert the prepared sample into the cell holder. Point the triangle mark on the sample cell away from the keypad. Go to step 15.



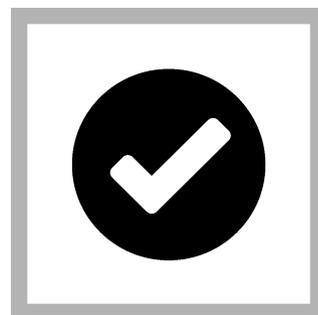
13. Set and start a timer for 3 minutes. A 3-minute reaction time starts.



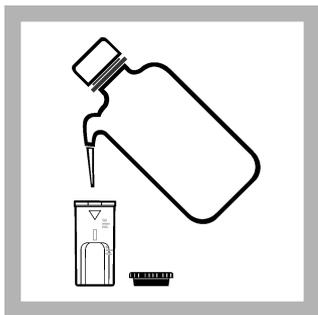
14. **Total chlorine measurement:** After 3 minutes and within 6 minutes of the reagent addition, insert the prepared sample into the cell holder. Point the triangle mark on the sample cell away from the keypad.



15. Install the instrument cap over the cell holder.



16. Push **READ**. Results show in mg/L chlorine ( $\text{Cl}_2$ ).



17. Immediately empty the sample cell. Rinse the sample cell and cap three times with deionized water.

## Interferences

| Interfering substance   | Interference level   |
|---|--|
| Acidity   | More than 150 mg/L CaCO <sub>3</sub> . The full color may not develop or the color may fade instantly. Adjust to pH 6–7 with 1 N Sodium Hydroxide. Measure the amount to be added on a separate sample aliquot, then add the same amount to the sample that is tested. Correct the test result for the dilution from the volume addition.  |
| Alkalinity  | More than 250 mg/L CaCO <sub>3</sub> . The full color may not develop or the color may fade instantly. Adjust to pH 6–7 with 1 N Sulfuric Acid. Measure the amount to add on a separate sample aliquot, then add the same amount to the sample that is tested. Correct the test result for the dilution from the volume addition.  |
| Bromine, Br <sub>2</sub>  | Positive interference at all levels  |
| Chlorine Dioxide, ClO <sub>2</sub>  | Positive interference at all levels  |
| Chloramines, organic  | May interfere  |
| Hardness  | No effect at less than 1000 mg/L as CaCO <sub>3</sub>  |
| Iodine, I <sub>2</sub>  | Positive interference at all levels  |
| Manganese, Oxidized (Mn <sup>4+</sup> , Mn <sup>7+</sup> ) or Chromium, Oxidized (Cr <sup>6+</sup> )  | Pre-treat the sample as follows: <ol style="list-style-type: none"> <li>1. Adjust the sample pH to 6–7.</li> <li>2. Add 3 drops of Potassium Iodide (30-g/L) to 10 mL of sample.</li> <li>3. Mix and wait 1 minute.</li> <li>4. Add 3 drops of Sodium Arsenite (5-g/L) and mix.</li> <li>5. Use the test procedure to measure the concentration of the treated sample.</li> <li>6. Subtract this result from the result without the treatment to obtain the correct chlorine concentration.</li> </ol> |
| Monochloramine  | For conventional free chlorine disinfection (beyond the breakpoint), monochloramine concentrations are very low. If monochloramine is in the sample, its interference in the free chlorine test changes with the temperature, the relative amount of monochloramine to free ammonia and the time necessary to do the analysis.<br><a href="#">Table 1</a> gives the approximate interference levels of monochloramine in the free chlorine test as mg/L Cl <sub>2</sub> .                              |
| Ozone   | Positive interference at all levels  |
| Peroxides   | May interfere  |
| Adjust to pH 6–7 with acid (Sulfuric Acid, 1 N) or base (Sodium Hydroxide, 1 N). Correct the test result for the dilution caused by the volume additions. | Can prevent the correct pH adjustment (of the sample) by the reagents. Sample pretreatment may be necessary.   |

**Table 1 Monochloramine level versus temperature**

| NH <sub>2</sub> Cl<br>(as Cl <sub>2</sub> ) | Sample temperature |               |               |               |
|---|--------------------|---------------|---------------|---------------|
|   | 5 °C (40 °F)       | 10 °C (50 °F) | 20 °C (68 °F) | 30 °C (83 °F) |
| 1.2   | 0.2                | 0.2           | 0.3           | 0.3           |
| 2.5   | 0.4                | 0.5           | 0.6           | 0.6           |
| 3.5   | 0.5                | 0.6           | 0.7           | 0.8           |

**Pollution prevention and waste management**

If sodium arsenite was added to the sample for manganese or chromium interferences, the reacted samples will contain arsenic and must be disposed of as a hazardous waste. Dispose of reacted solutions according to local, state and federal regulations. must be disposed of as a hazardous waste. Dispose of reacted solutions according to local, state and federal regulations.

**Accuracy check****Standard additions method**

Use the standard additions method to validate the test procedure, reagents and instrument and to find if there is an interference in the sample.

Items to collect:

- Chlorine Standard Solution, 2-mL PourRite Ampule, 50–75 mg/L (use mg/L on label)
- Ampule breaker
- Pipet, TenSette, 0.1–1.0 mL and tips

1. Prepare three spiked samples: use the TenSette pipet to add 0.1 mL, 0.2 mL and 0.3 mL of the standard solution, respectively, to three 5-mL portions of fresh sample. Mix well.
2. Use the test procedure to measure the concentration of each of the spiked samples. Start with the smallest sample spike. Measure each of the spiked samples in the instrument.
3. Compare the expected result to the actual result. The expected increase in the chlorine concentration is the Cl<sub>2</sub> mg/L concentration from the label of the standard solution multiplied by 0.1 mL for every 5 mL of standard solution added.

**Standard solution method**

If the Standard Calibration Adjust feature is used to adjust the calibration curve of the DR300 or Pocket Colorimeter II, the concentration of the chlorine standard must be between 4.5 and 7.0 mg/L chlorine for the HR procedure.

**Verification of on-line analyzers**

This procedure can be used to meet the requirements of USEPA Method 334.0 - Determination of Residual Chlorine in Drinking Water Using an On-line Chlorine Analyzer. The procedure and requirements for compliance with EPA Method 334.0 can be downloaded directly from <http://www.hach.com/method334>.

**Method performance**

The method performance data that follows was derived from laboratory tests that were measured on a DR300 and a Pocket Colorimeter II during ideal test conditions. Users can get different results under different test conditions.

**Precision (95% confidence interval)**5.0 ± 0.2 mg/L Cl<sub>2</sub>**Summary of method**

Chlorine can be in water as free chlorine and as combined chlorine. Both forms can be in the same solution and can be determined together as total chlorine. Free chlorine is in a solution as hypochlorous acid or hypochlorite ion. Combined chlorine represents a combination of chlorine-containing compounds, including monochloramine, dichloramine, nitrogen trichloride and other chloro derivatives. The combined chlorine oxidizes iodide (I<sup>-</sup>) to iodine (I<sub>2</sub>). The iodine and free chlorine reacts with DPD (N,N-diethyl-p-phenylenediamine) to form a red solution. The color intensity is proportional to the chlorine concentration. To determine the concentration of combined chlorine, complete a free chlorine test and a total chlorine test. Subtract the results of the free chlorine test from the total chlorine test to get the combined chlorine concentration.

To increase the range of analysis for the DPD method for total and free chlorine, add more indicator in proportion to the sample volume. For example, add a larger powder pillow of DPD Chlorine Reagent to a 5-mL sample.

**Consumables and replacement items****Required reagents**

| Description                                     | Quantity/test | Unit    | Item no. |
|---|---------------|---------|----------|
| DPD Free Chlorine Reagent Powder Pillow, 10 mL  | 2             | 100/pkg | 2105569  |
| DPD Total Chlorine Reagent Powder Pillow, 10 mL | 2             | 100/pkg | 2105669  |

**Required apparatus**

| Description              | Quantity/test | Unit  | Item no. |
|--------------------------|---------------|-------|----------|
| Sample cells, 1-cm/10-mL | 2             | 2/pkg | 4864302  |

**Recommended standards and apparatus**

| Description  | Unit   | Item no. |
|--|--------|----------|
| Chlorine Standard Solution, 2-mL PourRite <sup>®</sup> Ampules, 50–75 mg/L | 20/pkg | 1426820  |
| Chlorine Standard Solution, 10-mL Voluette <sup>®</sup> Ampule, 50–75 mg/L | 16/pkg | 1426810  |
| Ampule Breaker, 10-mL Voluette <sup>®</sup> Ampules                        | each   | 2196800  |
| PourRite <sup>®</sup> Ampule Breaker, 2-mL                                 | each   | 2484600  |

**Optional reagents and apparatus**

| Description  | Unit       | Item no. |
|--|------------|----------|
| Mixing cylinder, graduated, 25-mL                      | each       | 2088640  |
| Potassium Iodide, 30-g/L                               | 100 mL     | 34332    |
| Sodium Arsenite, 5-g/L                                 | 100 mL     | 104732   |
| Sodium Hydroxide Standard Solution, 1.0 N              | 100 mL MDB | 104532   |
| Sulfuric Acid Standard Solution, 1 N                   | 100 mL MDB | 127032   |
| Pipet, TenSette <sup>®</sup> , 0.1–1.0 mL              | each       | 1970001  |
| Pipet tips for TenSette <sup>®</sup> Pipet, 0.1–1.0 mL | 50/pkg     | 2185696  |
| Pipet tips for TenSette <sup>®</sup> Pipet, 0.1–1.0 mL | 1000/pkg   | 2185628  |

**Optional reagents and apparatus (continued)**

| Description  | Unit      | Item no. |
|--|-----------|----------|
| Paper, pH, 0–14 pH range   | 100/pkg   | 2601300  |
| DPD Free Chlorine Reagent Powder Pillows, 25 mL                    | 1000/pkg  | 1407028  |
| DPD Total Chlorine Reagent Powder Pillows, 25 mL                   | 1000/pkg  | 1406428  |
| SwifTest™ dispenser for free chlorine <sup>1</sup>                 | each      | 2802300  |
| SwifTest™ dispenser for total chlorine <sup>2</sup>                | each      | 2802400  |
| DPD Free Chlorine Reagent, 10-mL, SwifTest™ Dispenser refill vial  | 250 tests | 2105560  |
| DPD Total Chlorine Reagent, 10-mL, SwifTest™ Dispenser refill vial | 250 tests | 2105660  |
| SpecCheck™ Gel Secondary Standard Kit, Chlorine DPD, 0–10 mg/L     | 4/pkg     | 2893300  |
| Water, organic-free  | 500 mL    | 2641549  |

<sup>1</sup> Includes one vial of 2105560 for 250 tests.

<sup>2</sup> Includes one vial of 2105660 for 250 tests.

USEPA DPD Method<sup>1</sup>

Method 8021 (Free) 8167 (Total)

0.02 to 2.00 mg/L Cl<sub>2</sub> (LR)

Powder Pillows or AccuVac<sup>®</sup> Ampuls

**Scope and application:** For testing residual chlorine and chloramines in water, wastewater, estuary water and seawater; USEPA-accepted for reporting for drinking and wastewater analyses.<sup>2</sup> This product has not been evaluated to test for chlorine and chloramines in medical applications in the United States.

<sup>1</sup> Adapted from Standard Methods for the Examination of Water and Wastewater.

<sup>2</sup> Procedure is equivalent to USEPA and Standard Method 4500-Cl G for drinking water and wastewater analysis.



## Test preparation

### Before starting

Analyze the samples immediately. The samples cannot be preserved for later analysis.

Always do tests in sample cells or AccuVac<sup>®</sup> Ampuls. Do not put the instrument in the sample or pour the sample into the cell holder.

Make sure that the sample cells are clean and there are no scratches where the light passes through them.

Rinse the sample cell and cap with the sample three times before the sample cell is filled.

Make sure that there are no fingerprints or liquid on the external surface of the sample cells or AccuVac<sup>®</sup> Ampuls. Wipe with a lint-free cloth before measurement.

Cold waters can cause condensation on the sample cell or bubbles in the sample cell during color development. Examine the sample cell for condensation or bubbles. Remove condensation with a lint-free cloth. Invert the sample cell to remove bubbles.

Install the instrument cap over the cell holder before ZERO or READ is pushed.

After the test, immediately empty and rinse the sample cell. Rinse the sample cell and cap three times with deionized water.

Do not use the same sample cells for free and total chlorine. If trace iodide from the total chlorine reagent is carried over into the free chlorine determination, monochloramine will interfere. It is best to use separate, dedicated sample cells for free and total chlorine measurements.

If the test result is over-range, or if the sample temporarily turns yellow after the reagent addition, dilute the sample with a known volume of high quality, chlorine demand-free water and do the test again. Some loss of chlorine may occur due to the dilution. Multiply the result by the dilution factor. Additional methods are available to measure chlorine without dilution.

For the best results, measure the reagent blank value for each new lot of reagent. Replace the sample with deionized water in the test procedure to determine the reagent blank value. Subtract the reagent blank value from the sample results.

The AccuVac Ampul Snapper makes AccuVac Ampul tests easier to do. The AccuVac Ampul Snapper keeps the broken tip of the ampul, prevents exposure to the sample and provides controlled conditions for filling the ampule.

An AccuVac Ampul for Blanks can be used to zero the instrument in the AccuVac test procedure.

The SwifTest Dispenser for Free Chlorine or Total Chlorine can be used in place of the powder pillow in the test procedures. One dispensation equals one powder pillow for 10-mL samples.

Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

Dispose of reacted solutions according to local, state and federal regulations. Refer to the Safety Data Sheets for disposal information for unused reagents. Refer to the environmental, health and safety staff for your facility and/or local regulatory agencies for further disposal information.

## Items to collect

### Powder pillows

| Description  | Quantity |
|--|----------|
| <b>Chlorine, Free:</b> DPD Free Chlorine Reagent Powder Pillows, 10-mL   | 1        |
| <b>Chlorine, Total:</b> DPD Total Chlorine Reagent Powder Pillows, 10-mL | 1        |
| Sample cells, 25-mm (10 mL)  | 2        |

Refer to [Consumables and replacement items](#) on page 7 for order information.

### AccuVac Ampuls

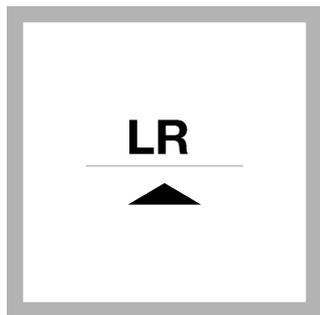
| Description   | Quantity |
|---|----------|
| <b>Chlorine, Free:</b> DPD Free Chlorine Reagent AccuVac Ampuls   | 1        |
| <b>Chlorine, Total:</b> DPD Total Chlorine Reagent AccuVac Ampuls | 1        |
| Beaker, 50-mL   | 1        |
| Stopper for 18-mm tubes and AccuVac Ampuls                        | 1        |
| Sample cells, 25-mm (10 mL)                                       | 1        |

Refer to [Consumables and replacement items](#) on page 7 for order information.

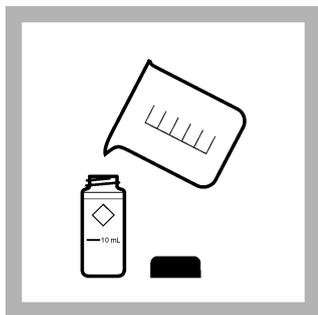
## Sample collection

- Analyze the samples immediately. The samples cannot be preserved for later analysis.
- Chlorine is a strong oxidizing agent and is unstable in natural waters. Chlorine reacts quickly with various inorganic compounds and more slowly with organic compounds. Many factors, including reactant concentrations, sunlight, pH, temperature and salinity influence the decomposition of chlorine in water.
- Collect samples in clean glass bottles. Do not use plastic containers because these can have a large chlorine demand.
- Pretreat glass sample containers to remove chlorine demand. Soak the containers in a weak bleach solution (1 mL commercial bleach to 1 liter of deionized water) for at least 1 hour. Rinse fully with deionized or distilled water. If sample containers are rinsed fully with deionized or distilled water after use, only occasional pretreatment is necessary.
- Make sure to get a representative sample. If the sample is taken from a spigot or faucet, let the water flow for at least 5 minutes. Let the container overflow with the sample several times and then put the cap on the sample container so that there is no headspace (air) above the sample.

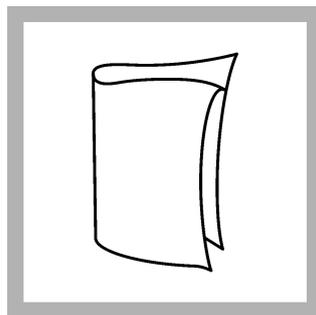
## Powder pillow procedure



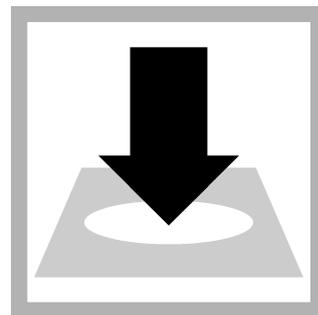
**1. Set the instrument to low range (LR).**  
For DR300, push the up arrow button. For PCII, push the menu button, checkmark button, then the menu button again.



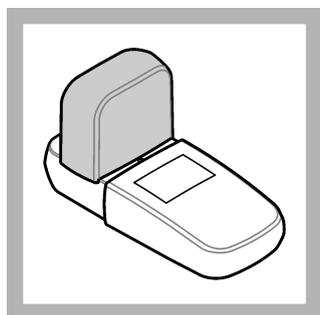
**2. Prepare the blank:**  
Rinse a sample cell and cap three times with sample. Fill the sample cell to the 10-mL mark with sample. Close the sample cell.



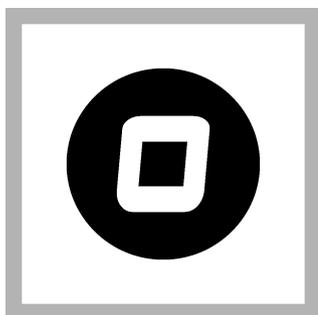
**3. Clean the blank sample cell.**



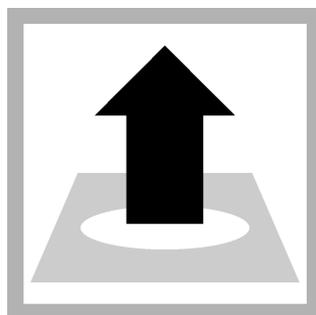
**4. Insert the blank into the cell holder.** Point the diamond mark on the sample cell toward the keypad.



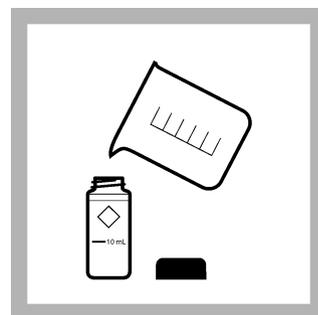
**5. Install the instrument cap over the cell holder.**



**6. Push ZERO.** The display shows "0.00".



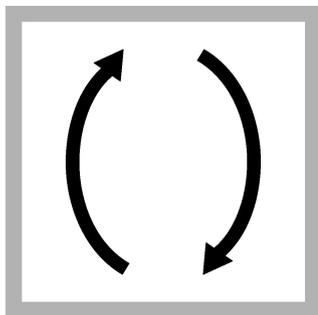
**7. Remove the sample cell from the cell holder.**



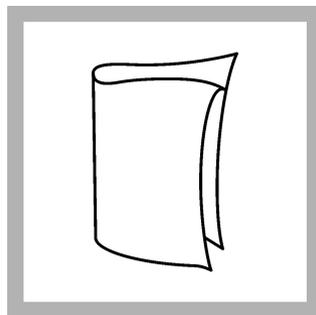
**8. Prepare the sample:**  
Rinse a second sample cell and cap three times with sample. Fill the sample cell to the 10-mL mark with sample.



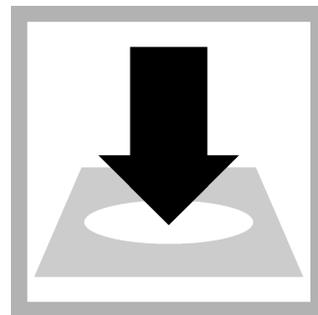
**9. Add one 10-mL DPD Free Chlorine Reagent Powder Pillow or one 10-mL DPD Total Chlorine Reagent Powder Pillow to the second sample cell.**



**10. Close the sample cell.** Invert the sample cell for about **20 seconds** to dissolve the reagent. Undissolved powder will not affect accuracy.  
A pink color will show if chlorine is in the sample.



**11. Clean the prepared sample cell.**

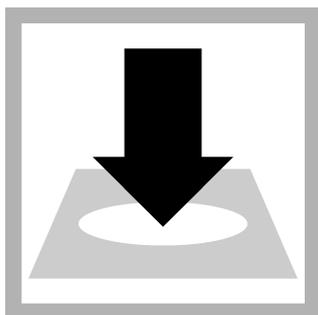


**12. Free chlorine measurement:** Within 1 minute of the reagent addition, insert the prepared sample into the cell holder. Point the diamond mark on the sample cell toward the keypad.

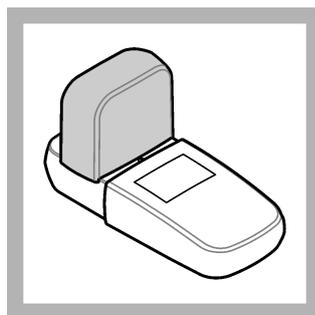
Go to step [15](#).



**13.** Set and start a timer for 3 minutes. A 3-minute reaction time starts.



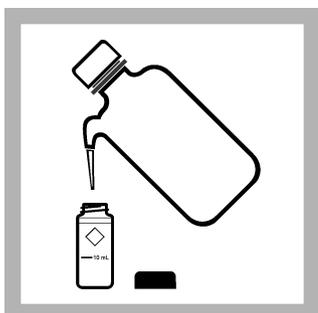
**14. Total chlorine measurement:** After 3 minutes and within 6 minutes of the reagent addition, insert the prepared sample into the cell holder. Point the diamond mark on the sample cell toward the keypad.



**15.** Install the instrument cap over the cell holder.

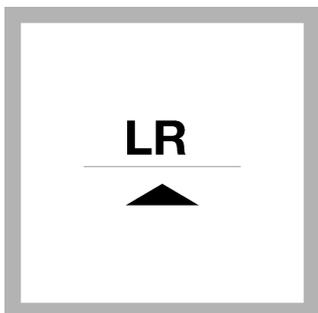


**16.** Push **READ**. Results show in mg/L  $\text{Cl}_2$ .

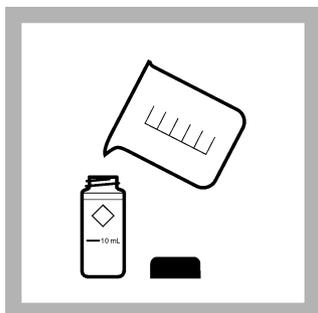


**17.** Immediately empty the sample cell. Rinse the sample cell and cap three times with deionized water.

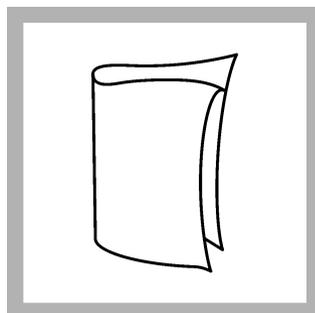
### AccuVac<sup>®</sup> Ampul procedure



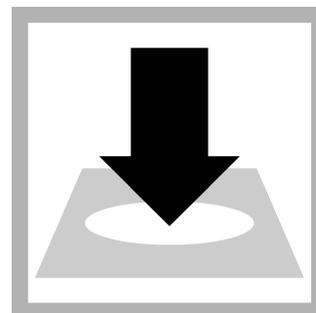
**1.** Set the instrument to low range (LR).  
For DR300, push the up arrow button. For PCII, push the menu button, checkmark button, then the menu button again.



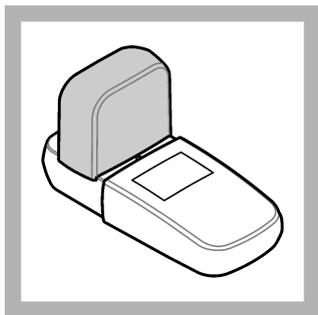
**2. Prepare the blank:** Rinse a sample cell and cap three times with sample. Fill the sample cell to the 10-mL mark with sample. Close the sample cell.



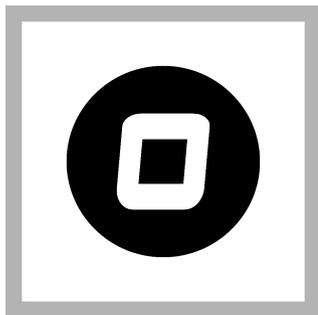
**3.** Clean the blank sample cell.



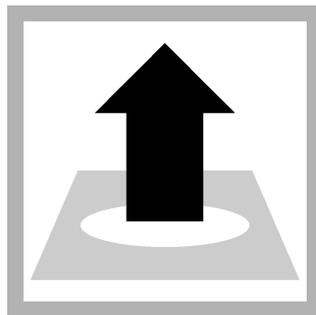
**4.** Insert the blank into the cell holder. Point the diamond mark on the sample cell toward the keypad.



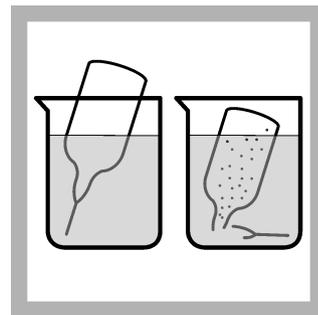
5. Install the instrument cap over the cell holder.



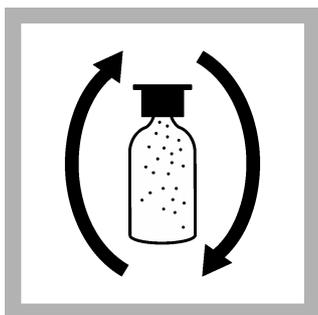
6. Push **ZERO**. The display shows "0.00".



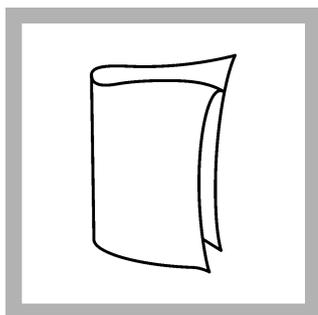
7. Remove the sample cell from the cell holder.



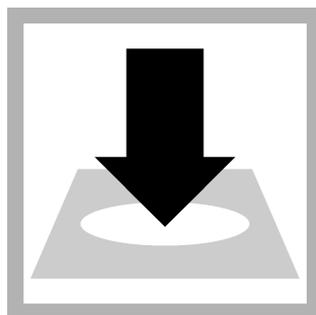
8. **Prepare the sample:** Collect at least 40 mL of sample in a 50-mL beaker. Fill a DPD Free Chlorine Reagent AccuVac Ampul or a DPD Total Chlorine Reagent AccuVac Ampul with sample. Keep the tip immersed while the AccuVac Ampul fills completely.



9. Quickly invert the AccuVac Ampul several times to mix.



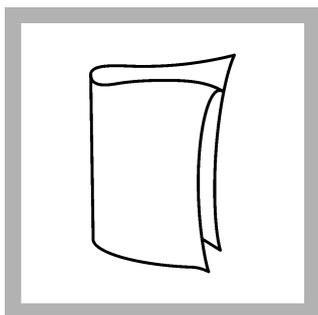
10. Clean the AccuVac Ampul.



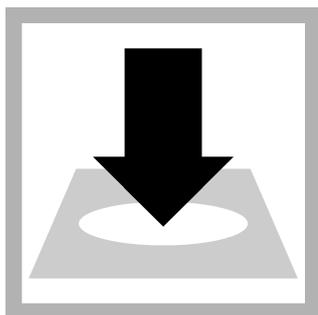
11. **Free chlorine measurement:** Within 1 minute of the reagent addition, insert the prepared sample AccuVac Ampul into the cell holder. Go to step 15.



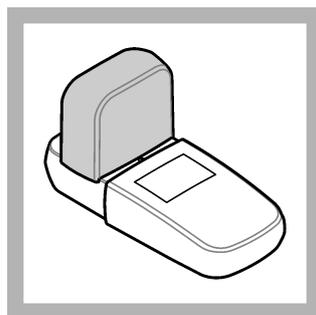
12. Set and start a timer for 3 minutes. A 3-minute reaction time starts.



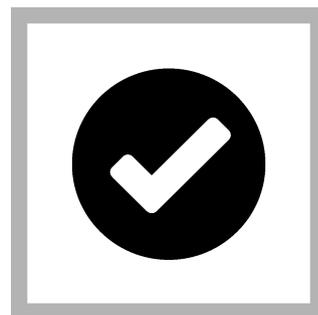
13. When the timer expires, clean the prepared sample cell.



14. **Total chlorine measurement:** Within 6 minutes of the reagent addition, insert the prepared sample AccuVac Ampul into the cell holder.



15. Install the instrument cap over the cell holder.



16. Push **READ**. Results show in mg/L Cl<sub>2</sub>.

## Interferences

| Interfering substance  | Interference level   |
|--|--|
| Acidity  | More than 150 mg/L CaCO <sub>3</sub> . The full color may not develop or the color may fade instantly. Adjust to pH 6–7 with 1 N Sodium Hydroxide. Measure the amount to add on a separate sample aliquot, then add the same amount to the sample that is tested. Correct the test result for the dilution from the volume addition.   |
| Alkalinity   | More than 250 mg/L CaCO <sub>3</sub> . The full color may not develop or the color may fade instantly. Adjust to pH 6–7 with 1 N Sulfuric Acid. Measure the amount to add on a separate sample aliquot, then add the same amount to the sample that is tested. Correct the test result for the dilution from the volume addition.  |
| Bromine, Br <sub>2</sub>   | Positive interference at all levels  |
| Chlorine Dioxide, ClO <sub>2</sub>   | Positive interference at all levels  |
| Inorganic chloramines  | Positive interference at all levels  |
| Chloramines, organic   | May interfere in the result for total chlorine analysis  |
| Hardness   | No effect at less than 1000 mg/L as CaCO <sub>3</sub>  |
| Manganese, Oxidized (Mn <sup>4+</sup> , Mn <sup>7+</sup> ) or Chromium, Oxidized (Cr <sup>6+</sup> ) | Pre-treat the sample as follows: <ol style="list-style-type: none"> <li>1. Adjust the sample pH to 6–7.</li> <li>2. Add 3 drops of Potassium Iodide (30-g/L) to 10 mL of sample.</li> <li>3. Mix and wait 1 minute.</li> <li>4. Add 3 drops of Sodium Arsenite (5-g/L) and mix.</li> <li>5. Use the test procedure to measure the concentration of the treated sample.</li> <li>6. Subtract this result from the result without the treatment to obtain the correct chlorine concentration.</li> </ol> |
| Monochloramine   | Causes a gradual drift to higher readings. When read within 1 minute after reagent addition, 3 mg/L monochloramine causes less than a 0.1 mg/L increase in the reading.  |
| Ozone  | Positive interference at all levels  |
| Peroxides  | May interfere  |
| Highly buffered samples or extreme sample pH   | Can prevent the correct pH adjustment (of the sample) by the reagents. Sample pretreatment may be necessary. Adjust to pH 6–7 with acid (Sulfuric Acid, 1 N) or base (Sodium Hydroxide, 1 N). Correct the test result for the dilution caused by the volume additions.   |

## Pollution prevention and waste management

If sodium arsenite was added to the sample for manganese or chromium interferences, the reacted samples will contain arsenic and must be disposed of as a hazardous waste. Dispose of reacted solutions according to local, state and federal regulations. must be disposed of as a hazardous waste. Dispose of reacted solutions according to local, state and federal regulations.

## Accuracy check

### Standard additions method

Use the standard additions method to validate the test procedure, reagents and instrument and to find if there is an interference in the sample.

Items to collect:

- Chlorine Standard Solution, 2-mL PourRite® Ampule, 25–30 mg/L (use mg/L on label)
- Ampule breaker
- Pipet, TenSette®, 0.1–1.0 mL and tips

1. Prepare three spiked samples: use the TenSette pipet to add 0.1 mL, 0.2 mL and 0.3 mL of the standard solution, respectively, to three 10-mL portions of fresh sample. Mix well.  
**Note:** For AccuVac<sup>®</sup> Ampuls, add 0.4 mL, 0.8 mL and 1.2 mL of the standard solution to three 50-mL portions of fresh sample.
2. Use the test procedure to measure the concentration of each of the spiked samples. Start with the smallest sample spike. Measure each of the spiked samples in the instrument.
3. Compare the expected result to the actual result. The expected increase in the chlorine concentration is the Cl<sub>2</sub> mg/L concentration from the label of the standard solution multiplied by 0.1 mL for every 10 mL of standard solution added.

### Standard solution method

If the Standard Calibration Adjust feature is used to adjust the calibration curve of the DR300 or Pocket Colorimeter II, the concentration of the chlorine standard must be between 0.50 and 1.50 mg/L chlorine for the LR procedure.

### Verification of on-line analyzers

This procedure can be used to meet the requirements of USEPA Method 334.0 - Determination of Residual Chlorine in Drinking Water Using an On-line Chlorine Analyzer. The procedure and requirements for compliance with EPA Method 334.0 can be downloaded directly from <http://www.hach.com/method334>.

### Method performance

The method performance data that follows was derived from laboratory tests that were measured on a DR300 and a Pocket Colorimeter II during ideal test conditions. Users can get different results under different test conditions.

| Precision (95% confidence interval) |
|-------------------------------------|
| 1.00 ± 0.05 mg/L Cl <sub>2</sub>    |

### Summary of method

Chlorine can be in water as free chlorine and as combined chlorine. Both forms can be in the same solution and can be determined together as total chlorine. Free chlorine is in a solution as hypochlorous acid or hypochlorite ion. Combined chlorine represents a combination of chlorine-containing compounds, including monochloramine, dichloramine, nitrogen trichloride and other chloro derivatives. The combined chlorine oxidizes iodide (I<sup>-</sup>) to iodine (I<sub>2</sub>). The iodine and free chlorine reacts with DPD (N,N-diethyl-p-phenylenediamine) to form a red solution. The color intensity is proportional to the chlorine concentration. To determine the concentration of combined chlorine, complete a free chlorine test and a total chlorine test. Subtract the results of the free chlorine test from the total chlorine test to get the combined chlorine concentration.

### Consumables and replacement items

#### Required reagents

| Description   | Quantity/test | Unit    | Item no. |
|---|---------------|---------|----------|
| DPD Free Chlorine Reagent Powder Pillow, 10 mL        | 1             | 100/pkg | 2105569  |
| DPD Total Chlorine Reagent Powder Pillow, 10 mL       | 1             | 100/pkg | 2105669  |
| OR  |               |         |          |
| DPD Free Chlorine Reagent AccuVac <sup>®</sup> Ampul  | 1             | 25/pkg  | 2502025  |
| DPD Total Chlorine Reagent AccuVac <sup>®</sup> Ampul | 1             | 25/pkg  | 2503025  |

### Required apparatus (powder pillows)

| Description                              | Quantity/test | Unit  | Item no. |
|--|---------------|-------|----------|
| Sample cells, 10-mL round, 25 mm x 60 mm | 2             | 6/pkg | 2427606  |

### Required apparatus (AccuVac Ampul)

| Description                                 | Quantity/Test | Unit  | Item no. |
|---|---------------|-------|----------|
| Sample cell, 10-mL round, 25 mm x 60 mm     | 1             | 6/pkg | 2427606  |
| Beaker, 50 mL                               | 1             | each  | 50041H   |
| Stoppers for 18-mm tubes and AccuVac Ampuls | 2             | 6/pkg | 173106   |

### Recommended standards and apparatus

| Description  | Unit   | Item no. |
|--|--------|----------|
| Chlorine Standard Solution, 2-mL PourRite <sup>®</sup> Ampules, 25–30 mg/L | 20/pkg | 2630020  |
| PourRite <sup>®</sup> Ampule Breaker, 2-mL                                 | each   | 2484600  |

### Optional reagents and apparatus

| Description  | Unit       | Item no. |
|--|------------|----------|
| AccuVac <sup>®</sup> Ampul Snapper   | each       | 2405200  |
| Mixing cylinder, graduated, 25-mL  | each       | 2088640  |
| Potassium Iodide, 30-g/L   | 100 mL     | 34332    |
| Sodium Arsenite, 5-g/L   | 100 mL     | 104732   |
| Sodium Hydroxide Standard Solution, 1.0 N                                      | 100 mL MDB | 104532   |
| Sulfuric Acid Standard Solution, 1 N   | 100 mL MDB | 127032   |
| Pipet, TenSette <sup>®</sup> , 0.1–1.0 mL                                      | each       | 1970001  |
| Pipet tips for TenSette <sup>®</sup> Pipet, 0.1–1.0 mL                         | 50/pkg     | 2185696  |
| Pipet tips for TenSette <sup>®</sup> Pipet, 0.1–1.0 mL                         | 1000/pkg   | 2185628  |
| Paper, pH, 0–14 pH range   | 100/pkg    | 2601300  |
| DPD Free Chlorine Reagent Powder Pillows, 10 mL                                | 1000/pkg   | 2105528  |
| DPD Total Chlorine Reagent Powder Pillows, 10 mL                               | 1000/pkg   | 2105628  |
| SwifTest <sup>™</sup> dispenser for free chlorine <sup>1</sup>                 | each       | 2802300  |
| SwifTest <sup>™</sup> dispenser for total chlorine <sup>2</sup>                | each       | 2802400  |
| DPD Free Chlorine Reagent, 10-mL, SwifTest <sup>™</sup> Dispenser refill vial  | 250 tests  | 2105560  |
| DPD Total Chlorine Reagent, 10-mL, SwifTest <sup>™</sup> Dispenser refill vial | 250 tests  | 2105660  |
| SpecCheck <sup>™</sup> Secondary Standard Kit, Chlorine DPD, 0–2.0 mg/L Set    | each       | 2635300  |
| Water, organic-free  | 500 mL     | 2641549  |

<sup>1</sup> Includes one vial of 2105560 for 250 tests.

<sup>2</sup> Includes one vial of 2105660 for 250 tests.



FOR TECHNICAL ASSISTANCE, PRICE INFORMATION AND ORDERING:  
In the U.S.A. – Call toll-free 800-227-4224  
Outside the U.S.A. – Contact the HACH office or distributor serving you.  
On the Worldwide Web – [www.hach.com](http://www.hach.com); E-mail – [techhelp@hach.com](mailto:techhelp@hach.com)

HACH COMPANY  
WORLD HEADQUARTERS  
Telephone: (970) 669-3050  
FAX: (970) 669-2932



The Town of Chelmsford

## Appendix E

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### IDDE Employee Training Record



The Town of Chelmsford

Illicit Discharge Detection and Elimination (IDDE)  
Employee Training Record

Chelmsford, Massachusetts

Date of Training: 4/9/19

Duration of Training: 1 hr

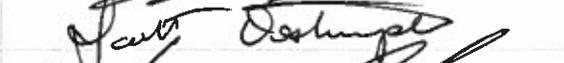
| Name             | Title    | Signature |
|------------------|----------|-----------|
| Scott Destrumpe  | Operator |           |
| David Pacheco    | D/K      |           |
| Bryan Edwards    | Operator |           |
| Dennis Greenwood | Foreman  |           |

**Illicit Discharge Detection and Elimination (IDDE)  
Employee Training Record**

**Chelmsford, Massachusetts**

Date of Training: 7/31/19

Duration of Training: 1 hr

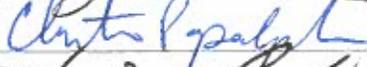
| Name             | Title                | Signature  |
|------------------|----------------------|--|
| James Levesque   | Truck Driver/Laborer |   |
| Andrew Silva     | Truck Driver         |   |
| Scott Destrempe  | operator             |   |
| David Pacheco    | Operator             |   |
| Stephen Rice     | Truck Driver/Laborer |   |
| Dennis Greenwood | Foreman              |   |
| Bryan Edwards    | Operator             |  |
|                  |                      |  |
|                  |                      |  |
|                  |                      |  |
|                  |                      |  |

**Illicit Discharge Detection and Elimination (IDDE)  
Employee Training Record**

**Chelmsford, Massachusetts**

**Date of Training:** 2/27/2020

**Duration of Training:** 1 hour

| Name                   | Title         | Signature   |
|------------------------|---------------|---|
| Scott Destrempé        | operator      |    |
| Andrew Silva           | Truck Driver  |    |
| Jimmy Levesque         | Trucker       |    |
| Stephen Rice           | Trucker       |    |
| Dennis Greenwood       | farmer        |    |
| Bryan Edwards          | operator      |    |
| Christina Papadopoulos | Town Engineer |   |
| David Pacheco          | Operator      |  |
|                        |               |   |
|                        |               |   |
|                        |               |   |
|                        |               |   |
|                        |               |   |



The Town of Chelmsford

## Appendix F

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### Source Isolation and Confirmation Methods: Instructions and SOPs



## SOP 10: LOCATING ILLICIT DISCHARGES

### *Introduction*

An “illicit discharge” is any discharge to an engineered storm drain system that is not composed entirely of stormwater unless the discharge is defined as an allowable non-stormwater discharge under the 2003 Massachusetts MS4 Permit. Illicit discharges may enter the engineered storm drain system through direct or indirect connections, such as: 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). Illicit discharges can contribute high levels of pollutants, such as heavy metals, toxics, oil, grease, solvents, nutrients, and pathogens to receiving streams.

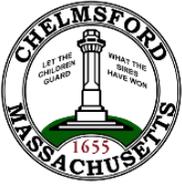
Illicit discharges can be located by several methods, including routine dry weather outfall inspections and catch basin inspections, which are described in detail in SOP 1, “Dry Weather Outfall Inspection” and SOP 3, “Catch Basin Inspection and Cleaning”, respectively, as well as from citizen reports.

This SOP assumes that the municipality has legal authority (i.e., a bylaw or ordinance) in place, per the requirements of the 2003 Massachusetts MS4 Permit, to prohibit the connection of non-stormwater discharges into the storm drain system. The authority or department for addressing illicit discharge reports would be clearly identified in the municipality’s legal authority. In Massachusetts, this is typically a combination of the Board of Health, the Department of Public Works (or Highway Department), and the local sanitary sewer department or commission. In some communities, the Conservation Commission may also play a role. This SOP refers to “appropriate authority” generically to reflect differences in how municipalities have identified these roles.

### *Identifying Illicit Discharges*

The following are often indicators of an illicit discharge from stormwater outfall:

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): indicator of the cross-connection of a sewer service.
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 sheen is not a pollutant but should be noted.

### *Citizen Call in Reports*

Reports by residents and other users of a water body can be effective tools in identifying the presence of illicit discharges. Many communities have set up phone hotlines for this purpose, or have provided guidance to local police departments and dispatch centers to manage data reported in this manner. Municipal employees and the general public should receive education to help identify the signs of illicit discharges and should be informed how to report such incidents.

When a call is received about a suspected illicit discharge, the attached IDDE Incident Tracking Sheet shall be used to document appropriate information. Subsequent steps for taking action to trace, document, and eliminate the illicit discharge are described in the following sections.

Potential illicit discharges reported by citizens should be reviewed on an annual basis to locate patterns of illicit discharges, identify high-priority catchments, and evaluate the call-in inspection program.

### *Tracing Illicit Discharges*

Whenever an illicit discharge is suspected, regardless of how it was identified, the attached IDDE Incident Tracking Sheet should be utilized. The Incident Tracking Sheet shall be provided to the appropriate authority (i.e., Board of Health, Department of Public Works, etc.), which shall promptly investigate the reported incident.

If the presence of an illicit discharge is confirmed by the authority, but its source is unidentified, additional procedures to determine the source of the illicit discharge should be completed.

1. Review and consider information collected when illicit discharge was initially identified, for example, the time of day and the weather conditions for the previous 72 hours. Also consider and review past reports or investigations of similar illicit discharges in the area.
2. Obtain storm drain mapping for the area of the reported illicit discharge. If possible, use a tracking system that can be linked to your system map, such as GIS.
3. Document current conditions at the location of the observed illicit discharge point, including odors, water appearance, estimated flow, presence of floatables, and other pertinent information. Photograph relevant evidence.
4. If there continues to be evidence of the illicit discharge, collect water quality data using the methods described in SOP 13, “Water Quality Screening in the Field”. This may include using field test kits or instrumentation, or collecting analytical samples for full laboratory analysis.
5. 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 on the IDDE Incident Tracking Sheet as well as with photographs.

6. 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.

If the source of the illicit discharge could not be determined by this survey, consider using dye testing, smoke testing, or closed-circuit television inspection (CCTV) to locate the illicit discharge.

#### [Dye Testing](#)

Dye testing is used to confirm a suspected illicit connection to a storm drain system. Prior to testing, permission to access the site should be obtained. Dye is discharged into the suspected fixture, and nearby storm drain structures and sanitary sewer manholes observed for presence of the dye. Each fixture, such as sinks, toilets, and sump pumps, should be tested separately. A third-party contractor may be required to perform this testing activity.

#### [Smoke Testing](#)

Smoke testing is a useful method of locating the source of illicit discharges when there is no obvious potential source. Smoke testing is an appropriate tracing technique for short sections of pipe and for pipes with small diameters. Smoke added to the storm drain system will emerge in connected locations. A third-party contractor may be required to perform this testing activity.

#### [Closed Circuit Television Inspection \(CCTV\)](#)

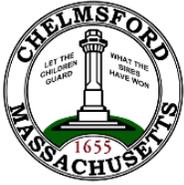
Televised video inspection can be used to locate illicit connections and infiltration from sanitary sewers. In CCTV, cameras are used to record the interior of the storm drain pipes. They can be manually pushed with a stiff cable or guided remotely on treads or wheels. A third-party contractor may be required to perform this testing activity.

If the source is located, follow steps for removing the illicit discharge. Document repairs, new sanitary sewer connections, and other corrective actions required to accomplish this objective. If the source still cannot be located, add the pipe segment to a future inspection program.

This process is demonstrated visually on the last page of this SOP.

#### [Removing Illicit Discharges](#)

Proper removal of an illicit discharge will ensure it does not recur. Refer to Table SOP 10-1, attached for, for examples of the notification process.



*Chelmsford Stormwater Program  
Standard Operating Procedures  
SOP 10: Locating Illicit Discharges*

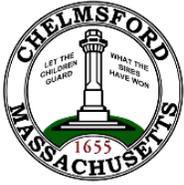
In any scenario, conduct a follow up inspection to confirm that the illicit discharge has been removed. Suspend access to the storm drain system if an “imminent and substantial danger” exists or if there is a threat of serious physical harm to humans or the environment.

*Attachments*

1. Illicit Discharge Incident Tracking Sheet

*Related Standard Operating Procedures*

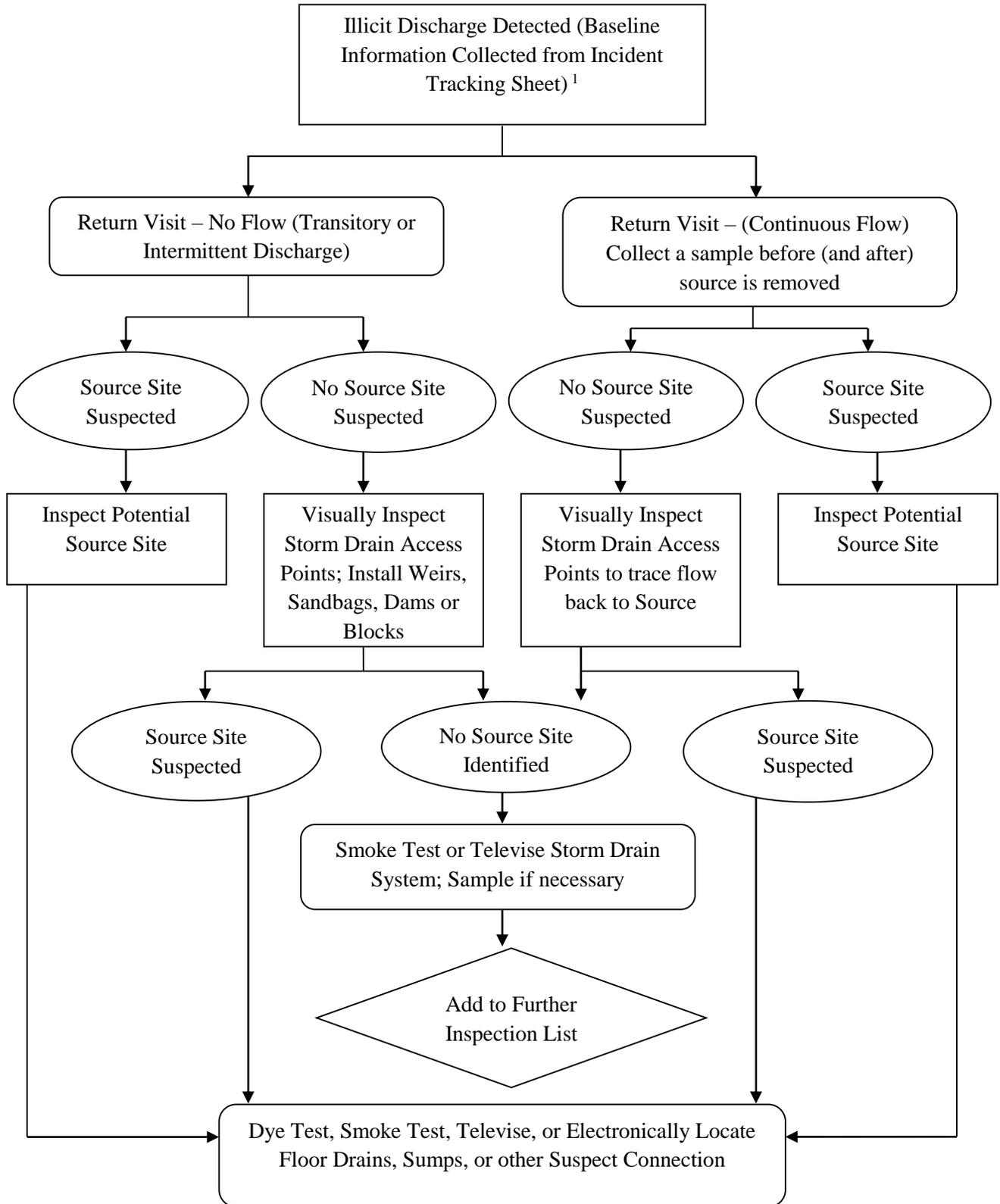
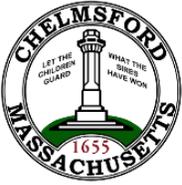
1. SOP 1: Dry Weather Outfall Inspection
2. SOP 2: Wet Weather Outfall Inspection
3. SOP 3: Catch Basin Inspection
4. SOP 13: Using Field Test Kits For Outfall Screening
5. SOP 15: Private Drainage Connections

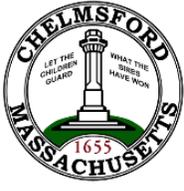


**Table SOP 10-1**

**Notification and Removal Procedures for Illicit Discharges  
 into the Municipal Separate Storm Sewer System**

| <b>Financially Responsible</b> | <b>Source Identified</b>  | <b>Enforcement Authority</b>                                    | <b>Procedure to Follow</b>  |
|--------------------------------|---|---|---|
| Private Property Owner         | One-time illicit discharge (e.g. spill, dumping, etc.)  | Ordinance enforcement authority (e.g. Code Enforcement Officer) | <ul style="list-style-type: none"> <li>• Contact Owner</li> <li>• Issue Notice of Violation</li> <li>• Issue fine</li> </ul>  |
| Private Property Owner         | Intermittent or continuous illicit discharge from legal connection  | Ordinance enforcement authority (e.g. Code Enforcement Officer) | <ul style="list-style-type: none"> <li>• Contact Owner</li> <li>• Issue Notice of Violation</li> <li>• Determine schedule for removal</li> <li>• Confirm removal</li> </ul> |
| Private Property Owner         | Intermittent or continuous illicit discharge from illegal connection or indirect (e.g. infiltration or failed septic) | Plumbing Inspector or ordinance enforcement authority           | <ul style="list-style-type: none"> <li>• Notify plumbing inspector</li> </ul>   |
| Municipal                      | Intermittent or continuous illicit discharge from illegal connection or indirect (e.g. failed sewer line)             | Ordinance enforcement authority (e.g. Code Enforcement Officer) | <ul style="list-style-type: none"> <li>• Issue work order</li> <li>• Schedule removal</li> <li>• Remove connection</li> <li>• Confirm removal</li> </ul>                    |
| Exempt 3 <sup>rd</sup> Party   | Any   | USEPA   | <ul style="list-style-type: none"> <li>• Notify exempt third party and USEPA of illicit discharge</li> </ul>  |





*Chelmsford Stormwater Program  
Standard Operating Procedures  
SOP 10: Locating Illicit Discharges*

<sup>1</sup> – *Guidelines and Standard Operating Procedures: Illicit Discharge Detection and Elimination and Pollution Prevention/Good Housekeeping for Stormwater Phase II Communities in New Hampshire, New Hampshire Estuary Project, 2006, p. 25, Figure 2-1.*

### Illicit Discharge Incident Tracking Sheet

|   |   |  |  |
|---|---|--|--|
| Incident ID:  |   |  |  |
| <b>Responder Information (for Citizen-Reported issues)</b>                                |   |  |  |
| Call Taken By:  |   | Call Date:   |  |
| Call Time:  |   | Precipitation (inches)<br>in past 24-48 hours:   |  |
| <b>Observer Information</b>   |   |  |  |
| Date and Time of Observation:   |   | Observed During Regular Maintenance or Inspections? <input type="checkbox"/> Yes <input type="checkbox"/> No |  |
| Caller Contact Information (optional) or Municipal Employee Information:                  |   |  |  |
| <b>Observation Location: (complete one or more below)</b>                                 |   |  |  |
| Latitude and Longitude:   |   |  |  |
| Stream Address or Outfall #:  |   |  |  |
| Closest Street Address:   |   |  |  |
| Nearby Landmark:  |   |  |  |
| <b>Primary Location Description</b>   |   | <b>Secondary Location Description:</b>   |  |
| <input type="checkbox"/> Stream Corridor (In or adjacent to stream)                       |   | <input type="checkbox"/> Outfall   | <input type="checkbox"/> In-stream Flow <input type="checkbox"/> Along Banks       |
| <input type="checkbox"/> Upland Area (Land not adjacent to stream)                        |   | <input type="checkbox"/> Near Storm Drain  | <input type="checkbox"/> Near other water source (stormwater pond, wetland, ect.): |
| Narrative description of location:  |   |  |  |
| <b>Upland Problem Indicator Description</b>   |   |  |  |
| <input type="checkbox"/> Dumping  | <input type="checkbox"/> Oil/Solvents/Chemicals                 | <input type="checkbox"/> Sewage  |  |
| <input type="checkbox"/> Detergent, suds, etc.  | <input type="checkbox"/> Other: _____                           |  |  |
| <b>Stream Corridor Problem Indicator Description</b>                                      |   |  |  |
| Odor  | <input type="checkbox"/> None                                   | <input type="checkbox"/> Sewage  | <input type="checkbox"/> Rancid/Sour <input type="checkbox"/> Petroleum (gas)      |
|   | <input type="checkbox"/> Sulfide (rotten eggs); natural gas     | <input type="checkbox"/> Other: Describe in "Narrative" section  |  |
| Appearance  | <input type="checkbox"/> "Normal"                               | <input type="checkbox"/> Oil Sheen   | <input type="checkbox"/> Cloudy <input type="checkbox"/> Foam                      |
|   | <input type="checkbox"/> Optical enhancers                      | <input type="checkbox"/> Discolored  |  |
|   | <input type="checkbox"/> Other: Describe in "Narrative" section |  |  |
| Floatables  | <input type="checkbox"/> None                                   | <input type="checkbox"/> Sewage (toilet paper, etc)  | <input type="checkbox"/> Algae <input type="checkbox"/> Trash or debris            |
|   | <input type="checkbox"/> Other: Describe in "Narrative" section |  |  |
| Narrative description of problem indicators:  |   |  |  |
| Suspected Source (name, personal or vehicle description, license plate #, address, etc.): |   |  |  |