Illicit Discharge Detection and Elimination (IDDE) Plan

PREPARED FOR

dcr
Massachusetts

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1

Introduction

1.1 MS4 Program

This Illicit Discharge Detection and Elimination (IDDE) Plan has been developed by the Department of Conservation and Recreation (DCR) to address the requirements of the United States Environmental Protection Agency's (EPA) 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.

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.

Some illicit discharges are intentional, such as dumping used oil (or other pollutants) 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.

1.3 Allowable Non-Stormwater Discharges

The following categories of non-stormwater discharges are allowed under the 2016 MS4 Permit unless the permittee, EPA 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
- Discharge from potable water sources
- Landscape irrigation or lawn watering
- Diverted stream flows
- Rising ground water
- Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20))
- Uncontaminated pumped groundwater
- Foundation drains or footing drains (not including active groundwater dewatering systems)
- Water from crawl space pumps
- Air conditioning condensation

- Springs
- Individual (non-commercial) resident car washing
- Natural riparian habitat or wetland flows
- De-chlorinated swimming pool discharges
- Fire-fighting activities
- Street wash waters
- Residential building wash waters without detergents
- Other water source not containing pollutants

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

1.4 Receiving Waters and Impairments

Appendix A lists the "impaired waters" that DCR's regulated outfalls discharge to, based on the most recent (2016) final 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.

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 systems 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 1-1**.

Figure 1-1. IDDE Investigation Procedure Framework

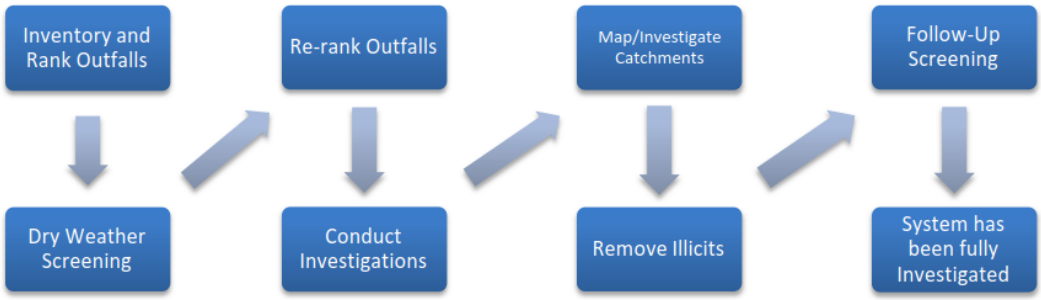

Table 1-1 DCR IDDE Program Implementation Timeline

	Completion Date from Effective Date of Permit (June 2018)					
IDDE Program Requirement	**1 Year**	**1.5 Years**	**2 Years**	**3 Years**	**7 Years**	**10 Years**
Written IDDE Program Plan	X					
Sanitary Sewer Overflow (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

1.6 Work Completed to Date

The 2003 MS4 Permit required each MS4 permittee 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 permittee was also required to define how confirmed discharges would be eliminated and how the removal would be documented. DCR has also completed 2016 MS4 Permit requirements for the first two years of the permit.

DCR has completed the following IDDE program activities consistent with the 2003 MS4 Permit and the 2016 MS4 Permit requirements:

- Developed a map of outfalls and receiving waters;
- Developed an IDDE policy;
- Completed additional storm system mapping, including the locations of catch basins, manholes, and some pipe connectivity;
- Conducted outfall sampling;
- 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 a written IDDE Plan in June 2019 (updated in June 2020);
- Developed a written catchment investigation procedure as part of the IDDE Plan;
- Completed Phase I mapping requirements;
- Updated outfall prioritization;
- Began catchment investigations for known problem outfalls; and
- Began dry weather screening.

2

Authority and Statement of IDDE Responsibilities

2.1 Legal Authority

DCR is updating an Illicit Discharge Disconnection Policy (**Appendix B**) to provide DCR 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; and
- Implement appropriate enforcement procedures and actions.

The Illicit Discharge Disconnection Policy is consistent with the 2016 MS4 Permit. In addition to the policy, DCR is in the process of drafting regulations which will provide DCR the legal authority to enforce instances of illegal connections or flows to its system.

2.2 Statement of Responsibilities

The Division of Engineering is the lead division within DCR responsible for implementing the IDDE program pursuant to the provisions of the Illicit Discharge Disconnection Policy. Other agencies or departments with responsibility for aspects of the program include:

- DCR General Counsel's Office – DCR's General Counsel will contact landowners with illicit discharges to request they remove the illicit discharge and set a deadline for response.

› Massachusetts Attorney General's Office - If a landowner does not remove the illicit discharge within the set deadlines, DCR General Counsel's Office will pursue legal action with the Massachusetts Attorney General's Office.

3

Stormwater System Mapping

DCR originally developed mapping of its stormwater system to meet the mapping requirements of the 2003 MS4 Permit. 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. DCR completed its Phase I mapping (see Section 3.1) as of June 30, 2020. DCR will report on the progress towards completion of the storm system map in each annual report.

DCR's most recent storm system map is available at this link: http://vhb.maps.arcgis.com/apps/webappviewer/index.html?id=1fffa8d7b9e144e793dcffb0445846e2.

3.1 Phase I Mapping

Phase I mapping must be completed within two (2) years of the effective date of the permit (June 30, 2020) and include the following information:

- Outfalls;
- Open channel conveyances (swales, ditches, etc.);
- Interconnections with other MS4s and other storm sewer systems;
- DCR 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;

- Surface public drinking water supplies, watersheds, and protection zones; and
- Initial catchment delineations. Topographic contours and drainage system information may be used to produce initial catchment delineations.

DCR completed initial Phase 1 mapping in June of 2020.

DCR's drainage system includes assets statewide and often includes complex interconnections with many other parties. DCR has begun to review and identify interconnections in the field and continues to work with municipalities and other agencies to identify additional interconnections. The interconnections flagged by the field crews have not been reviewed yet and so, at this time, interconnections are not provided in the public facing storm system map. If entities are interested in determining if a drainage system includes identified interconnections, please request from DCR Stormwater.

DCR has over 1,600 regulated outfalls mapped statewide. Hand delineating draft catchments to each outfall was deemed infeasible. DCR has created draft catchments using an automated approach based on topography, however these catchments are extremely rough and will be refined individually through catchment investigations. Since the draft catchment delineations are draft, they are not provided in the public facing storm system map at this time. If entities are interested in receiving the draft catchments, please request from DCR Stormwater.

3.2 Phase II Mapping

Phase II mapping must be completed within ten (10) years of the effective date of the permit (June 30, 2028) and include the following information:

- Outfall spatial location (latitude and longitude with a minimum accuracy of +/-30 feet);
- Pipes;
- Manholes;
- Catch basins; and
- Refined catchment delineations. Catchment delineations must be updated to reflect information collected during catchment investigations.

Since DCR does not own sanitary sewer systems or combined sewer systems (beyond private connections to municipal systems) these elements are not included in our mapping.

DCR is in the process of updating each of these components and is actively mapping their comprehensive drainage systems with DCR crews. This has included refining catchment delineations as part of Problem Outfall reviews.

4

Sanitary Sewer Overflows (SSOs)

The 2016 MS4 Permit requires permittees 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.

While DCR does not own sanitary sewer lines, beyond sewer laterals for their facilities, and is therefore not usually directly responsible for SSOs, DCR has completed an inventory of SSOs that have discharged from DCR laterals (**Table 4-1**) or from other entities onto DCR properties (**Table 4-2**) within the five (5) years prior to the effective date of the 2016 MS4 Permit, based on review of available documentation pertaining to SSOs and in coordination with those entities responsible for the respective sanitary sewer systems (e.g., municipalities). 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, DCR will coordinate with those entities responsible for the sanitary sewer system to 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, DCR will provide oral notice to MassDEP, EPA and the entity responsible for the sanitary sewer system within 24 hours and written notice to the responsible entity, EPA, and MassDEP within five (5) days of becoming aware of the SSO occurrence following MassDEP's Sanitary Sewer Overflow (SSO)/Bypass notification form.

MassDEP 24-hour Emergency Line: 1-888-304-1133			
EPA New England: 1-617-918-1510 5 Post Office Square Boston, MA 02109			
DEP Northeast Region (978) 694-3215 205B Lowell Street Wilmington, MA 01887	DEP Central Region (508) 792-7650 8 New Bond Street Worcester, MA 01606	DEP Southeast Region (508) 946-2750 20 Riverside Drive Lakeville, MA 02347	DEP Western Region (413) 784-1100 436 Dwight Street Springfield, MA 01103

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

Table 4-1 SSO Inventory – DCR Owned Sewer Discharges

Last Revision Date: August 28, 2020

SSO Location[1]	Discharge Statement[2]	Date/ Time[3]	Estimated Volume[4]	Description[5]	Mitigation Completed[6]	Mitigation Planned[7]
Union St. Hingham	Sewer discharge to Weir River	April, 2015	n/a	Force main sewer discharge – from Wompatuck State Park Campgrounds sewer lateral	Replacement of force main under Weir River	No addn mitigation needed
Pond St. – Corner of Woodland Rd. Stoneham	Sewer MH surcharge from DCR force main servicing Stoneham Zoo & DCR Labor Yard	November,2018	n/a	Pump Station temporarily off-line, when turned back on, sewer line overflowed gravity mainline	Sewer main inspected, water jetted & cleaned	No addn mitigation needed

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

Table 4-2 SSO Inventory – Other Entity Owned Sewer Discharges onto DCR Property

Last Revision Date: August 28, 2020 SSO Location[1]	Sewer System Owner	Discharge Statement[2]	Date[3]	Estimated Volume[4]	Description[5]
Nonantum Rd. Boston	Boston Water & Sewer Department	Surcharged Manhole from Daily Rink	February, 2017	n/a	Blocked or clogged line in main. BWSC addressed clog and notified DCR of overflow
Storrow Dr.	MWRA	Surcharge of BMC under Mass Ave. Bridhe on Storrow Dr.	Aug. 2019	n/a	Rain Event
Essex Street	City of Quincy	City staff have observed the SSO entering the tidal fingers near the manhole.	Jan. 21, 2020	n/a	At this time there is a formerly stubbed and capped clay pipe connected to the manhole which is resulting in the discharge
East Squantum Sreet	City of Quincy	The City suspected that there was a collapse/blockage on East Squantum Street	Jan. 21, 2020	n/a	Using their vactor/jetter, as noted above. They have been able to restore functional conditions to this sewer line, so that the bypassed flows from Aberdeen can b safely conveyed into the sewer system

[1] Location (approximate street crossing/address and receiving water, if any)
[2] Entity that owns or is otherwise responsible for sewer system where SSO occurred
[3] A clear statement of whether the discharge entered a surface water directly or entered the MS4
[4] Date(s) of each known SSO occurrence
[5] Description of the occurrence indicating known or suspected cause(s)

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.

5.1 Outfall Catchment Delineations

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

5.2 Outfall and Interconnection Inventory and Initial Ranking

The DCR Division of Engineering completed an initial outfall and interconnection inventory and priority ranking (**Appendix C**) to assess illicit discharge potential based on existing

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

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

information. 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 identifies each outfall and interconnection discharging from the MS4, records its location and condition, and provides a framework for tracking inspections, screenings and other IDDE program activities.

Outfalls and interconnections are classified into one of the following categories:

1. **Problem Outfalls**: Outfalls/interconnections with known or suspected contributions of illicit discharges based on existing information shall be designated as Problem Outfalls. This shall include any outfalls/interconnections where previous screening indicates likely sewer input. Likely sewer input indicators are any of the following:
    a) Olfactory or visual evidence of sewage;
    b) 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
    c) Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and detectable levels of chlorine.

    Dry weather screening and sampling, as described in **Section 6** of this IDDE Plan and Part 2.3.4.7.b of the MS4 Permit, is not required for Problem Outfalls. Instead, DCR will move right to investigating the discharge and trying to identify the source. Once the source is removed and follow up sampling indicates no potential illicit connections, the Problem Outfall shall be re-ranked as a High or Low Priority Outfall.
2. **High Priority Outfalls:** Outfalls/interconnections that have not been classified as Problem Outfalls and that are:
    a) Discharging to an area of concern to public health due to proximity of public beaches, recreational areas, surface water supplies, or shellfish beds; or
    b) Discharging to waterbodies impaired for bacteria or pathogens. (Note: this has been updated in June 2020 to match the MassDEP Final 2016 Integrated List of Waters.)
3. **Low Priority Outfalls:** Outfalls/interconnections determined by the permittee as low priority based on the ranking 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. The permit identifies that drainage from the following categories below can be excluded:
    a) Roadway drainage in undeveloped areas with no dwellings and no sanitary sewers;
    b) Drainage for athletic fields, parks, or undeveloped green space and associated parking without services; or

c) Cross-country drainage alignments (that neither cross nor are in proximity to sanitary sewer alignments) through undeveloped land.

DCR has identified approximately 200 outfalls to be excluded from the IDDE program as they are located away from presumed sanitary sewer systems, in undeveloped areas based on land use, and not in proximity to DCR building with restrooms. DCR will continue to refine excluded outfall status through catchment investigations.

Ranking Characteristics

Outfalls will be ranked into the above priority categories based on the following characteristics of the defined initial catchment areas, where information is available. As additional information becomes available, DCR may include additional relevant characteristics, including location-specific characteristics, as part of the ranking and will document the characteristics in this IDDE Plan. The characteristics below provide an overview.

- **Previous screening results** – previous screening/sampling results indicate likely sewer input (see criteria above for Problem Outfalls).
- **Past discharge complaints and reports.**
- **Discharging to Area of Concern to Public Health** – outfalls or interconnections that discharge to public beaches, recreational areas, surface water supplies and/or shellfish beds.
- **Impaired Waterbodies** – discharges to waters impaired for bacteria according to the most recent 303(d) list.
- **TMDL Watershed** – discharges to waters with an approved TMDL where illicit discharges may contribute to the pollutant of concern.
- **Density of generating sites within catchment** – outfalls or interconnections where known high-density generating sites are present within the drainage area. For DCR, this includes all labor yards and areas where fueling operations occur.

Appendix C includes DCR's current outfall inventory and priority ranking matrix.

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 Division of Engineering 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. While DCR performed outfall screening/sampling conducted under the 2003 MS4 Permit for their whole system, the list of analytes sampled was different and the results were not logged in a database for reference. Therefore, DCR is retesting the outfalls as described in this section.

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. DCR will use precipitation data from the nearest accurate weather station from the Weather Underground website[3] or similar data source for each property for determining dry weather conditions. DCR will identify at least one back-up station for each site also, as needed.

[3] https://www.wunderground.com/weatherstation/overview.asp

6.2 Dry Weather Screening/Sampling Procedure

6.2.1 General Procedure

6.2.1.1 Documents and Records

Sampling Records

All samples must be clearly labeled with a unique identifier provided for each site, the date and time of collection, and the analysis required. This information must also be listed on the chain of custody. Additionally, all samples must identify the sampler using their initials.

Field Records

Field notes will be collected using a mobile data collection application. The sampling team will measure pipe diameter and depth of flow (as percentage of pipe) as well as the results of the field test kit analyses for ammonia, surfactants, and chlorine and field measurements for pH, temperature, salinity, and specific conductivity. Additionally, flow velocity, approximate depth of water, water color, odor, observed floatables and sediment or debris deposits will be recorded. A photo of the structure should be taken and added to the database. A chain of custody form will be filled out at the time of sampling by the field crew. A carbon copy of the chain of custody will be retained by the field crew after the samples are delivered to the laboratory.

Laboratory Records

Upon completion of laboratory analysis, the laboratory will issue a full report in an electronic format describing the results of analysis for each sample submitted. This will include; a case narrative, sample results, quality control measures taken, information on the condition of the samples upon arrival at the lab and the sampling methodologies. A copy of the chain of custody will also be included by the laboratory with the laboratory report.

All data will be evaluated to confirm that it meets the quality control goals and that it is consistent with results typical for this type of work. Additional data collection will be scheduled if multiple data points do not meet the data quality objectives.

6.2.1.2 Quality Objectives, Criteria and Control

Data quality objectives are as follows:

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

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

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

Representativeness: Sample collection is intended to provide data representative of actual conditions at particular sampling locations. To achieve representativeness, sampling is carried out so as to eliminate, as much as possible, the possibility of cross contamination between the sampled locations and non-sampled locations as well as between multiple sampling locations. However, grab samples are only representative of a snapshot of water quality conditions at a given time. As such, they may not be representative of long-term conditions. Data collected must be evaluated with this limitation in mind.

Trip Blank: One blank sample will be collected per trip to the laboratory. Before any samples are taken, a trip blank will be created, by collecting a sample of distilled water using the field sampling equipment. It will remain in the same cooler as the samples for the duration of their trip to the laboratory.

QC Criteria: QC criteria are specified in **Table 6-1**. Data not meeting the criteria will be reviewed by the Project Manager. Data that does not meet laboratory QA/QC criteria will be flagged by the laboratory.

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

The pH, temperature, and specific conductivity measurements will be collected using an Oakton Multi-Parameter PCTSTestr 50 Series. Meters are calibrated on a monthly schedule. Calibration instructions for each parameter are below.

pH Calibration:

For best results, calibrate with certified accurate pH calibration standards (buffers). You may calibrate up to five points with the USA (1.68, 4.01, 7.00, 10.1, 12.45) or the NIST (1.68, 4.01, 6.86, 9.18, 12.45) buffer group.

1. Press ON/OFF to turn meter on and MODE ENT to select pH mode as needed.

2. Rinse the sensor with clean water. Immerse the sensor into your pH buffer and press ▲ CAL. The primary display will show the un-calibrated pH value, while the secondary display should search for and lock on the closest automatic calibration value.
3. Allow the primary display to stabilize, then press MODE ENT to confirm the calibration value. The primary value will blink briefly before the secondary value automatically scrolls thru the remaining pH buffers available for calibration.
4. Repeat steps 2 & 3 with additional buffers or press ▲ CAL to return to measurement mode.

Temperature Calibration:

The factory temperature should last for the life of the original sensor since it doesn't normally drift.

Conductivity Calibration (Automatic):

For best results, calibrate with certified accurate conductivity calibration standards. Selection of multi-point calibration will allow up to three of the following values, while single-point calibration will allow only one; choose 84 µS, 1413 µS, or 12.88 µS.

Conductivity Range	Automatic Calibration Value	Available With
0.0 – 200.0 µS	84 µS	PCS only
201 – 2000 µS	1413 µS	PC or PCS
2.01 – 20.00 mS	12.88 mS	PC or PCS

1. Press ON/OFF to turn meter on and MODE ENT to select conductivity mode as needed.
2. Rinse the sensor with clean water. Immerse the sensor into your standard and press ▲CAL. The primary display will show the un-calibrated value, while the secondary display should search for and lock on the closest automatic calibration value.
3. Allow the primary display to stabilize, then press MODE ENT to confirm the calibration value. The primary value will blink briefly before returning to measurement mode.
4. Repeat steps 2 & 3 with additional calibrations standards if desired.

Table 6-1 Analytical References and Quality Control Goals

Parameter	Lab/Equipment	Reporting Limits	Method	Water Quality Criteria or Guidelines	Precision	Accuracy	Completeness
pH	Oakton Multi-Parameter PCTSTestr 50	0 - 14	NA	6.5 – 8.3	0.02	+/- 0.1	90%
Temperature	Oakton Multi-Parameter PCTSTestr 50	0 – 50 °C	NA	28.3	0.1 °C	+/- 0.5 °C	90%
Specific Conductivity	Oakton Multi-Parameter PCTSTestr 50	0 – 1,999 µS/cm 2.00 to 20.00 mS/cm	NA	NA	5 µS/cm	+/- 1% F.S.	90%
Salinity	Oakton Multi-Parameter PCTSTestr 50	0 – 999 ppm 1.00 – 10.00 ppt	NA	NA	30% RPD	+/- 1% F.S.	90%
Ammonia	CHEMets Kit K-1510	0.02 mg/L	NA	0.5 mg/L	0.05 mg/L	+/- 20%	90%
Chlorine	CHEMets Kit I-2001	0.02 mg/L	NA	NA	0.02 mg/L	+/- 20%	90%
Surfactants	CHEMets Kit K-9400	0.125 mg/L	NA	0.25 mg/L	0.125 mg/L	+/- 20%	90%
E. Coli	Laboratory	>10 CFU/ 100 mL	1,603	235 CFU/100 mL	30% RPD	NA	90%
Enterococcus	Laboratory	10 CFU / 100 mL	1,600	104 CFU/100 mL	30% RPD	NA	90%

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

Each sample collected will be stored in the appropriate container for the specific parameter being analyzed. The appropriate containers for all parameters being analyzed are shown in **Table 6-2**. Each sample will be labeled with the sample ID, date and time of collection, sampler collector's initials and the parameter to be tested.

Table 6-2 Bottle List

Parameter	Lab	Bottle	Preservation
E. coli	Laboratory	120 mL sterile	Ice
Enterococci	Laboratory	120 mL sterile	Ice

A laboratory-specific chain of custody (COC) will also be completed. Each time the samples change hands (from the sampler to the courier, courier to laboratory, etc.), the sample labels will be checked against the COC to verify that all information matches. If discrepancies are found, actions will be taken to confirm the correct information is displayed and that all samples are accounted for. The laboratory will perform QA/QC procedures consistent with the standard operating procedures (SOPs) for the sampling methodology for each parameter.

Any inaccurate or incomplete field data will be discussed and re-measured before leaving the monitoring location. Inaccurate or incomplete information will be corrected before the files are finalized.

The laboratory will follow QA/QC procedures described in the attached SOP including initial calibration, the use of duplicates and laboratory control samples. Once sampling results are distributed by the laboratory, a Project Manager will review the results to confirm that they are consistent with the quality control goals listed in **Table 6-1**. Any discrepancies will be discussed with the laboratory.

6.2.1.3 General Steps

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 **Appendix D** for list of potential field equipment).
3. Conduct the outfall inspection during dry weather:
    a) Locate the outfall. If the outfall is not found, proceed to the next upstream structure. If an upstream structure is not found, update the database accordingly.
    b) In the event that an outfall is submerged, either partially or completely, or is 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. (Note, field staff may need to capture samples from multiple sampling points to capture a representative sample of the incoming flow.)

c) Mark and photograph the outfall or structure in the database.

d) Record the inspection information and outfall characteristics using DCR's mobile data collection. Inspectors will use ArcGIS Collector to gather screening and sampling data against mapped assets. 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), place a sandbag if the forecast for the next 48 hours shows dry weather. If the forecast does not show dry weather, revisit the outfall when there is 48 hours of dry weather as soon as possible after the initial observation and place a sandbag or sample flow if observed.
6. Input lab results from screening and sampling into DCR's database. Data captured through the mobile ArcGIS Collector will be automatically saved to the database.
7. Conduct review of all data entered into the database against lab reports and field notes for quality assurance purposes.
8. Analyze whether screening and sampling results require further follow up measures or indicate no signs of illicit discharges in the flow.
9. Include all screening data in the annual report.

6.2.2 Field Equipment

Appendix D includes a checklist of field equipment commonly used for dry weather (and wet weather) outfall screening and sampling. The listed items are suggested and should be updated as needed, based on specific samples and tests to be conducted and/or conditions. At the discretion of the sampling team, additional items can be added to the list at the end, and duplicative or unnecessary items can be removed or crossed out.

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[4] listed in **Table 6-1** plus pollutants of concern

[4] 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).

for the receiving water body. The general procedure for collection of outfall samples is as follows:

1. At least one day prior to sampling, coordinate with appropriate laboratory to schedule the laboratory analysis. This coordination will include the time of delivery and number of samples expected to be sent for analysis.
2. Visit the designated location(s) provided in two-person field crew.
3. Prior to the start of sampling, create a trip blank by filling a laboratory provided container with clean bottled water. The trip blank will have its own unique label and will be kept in a cooler with all other samples collected during that sampling event.
4. Upon arrival at an approved sampling location, record all pertinent observations in electronic format. Pertinent observations include but are not limited to: flow velocity, approximate depth of water, water color, odor, observed floatables, and sediment or debris deposits. Fill out comments section with any observations which cannot adequately be described using predefined categories on the field form.
5. If using bottle labels, fill out all sample information on sample bottle labels and field sheets. Make sure sample bottles are clean. If writing directly on lab sample bottle, skip to Step 6.
6. Put on protective gloves (nitrile/latex/other) before sampling. If writing directly on lab sample bottles, label sampling container. Collect sample with dipper or directly in sample containers. To sample, place a clean grab container in the approximate middle of observed flow. After the container has been filled, retrieve and swirl its contents to ensure that all surfaces of the container are covered and rinsed thoroughly and then dump out downstream of the sampling location. Follow this method a total of three times, to ensure that the grab container is fully rinsed.
7. Use grab container a fourth time to collect a final sample for analysis. If possible, collect water from the flow directly in the sample bottle. Be careful not to disturb sediments.
8. For samples requiring laboratory analyses, open a sterile container, provided by the laboratory. Use caution to ensure that only the outside of the container and its cap are handled to prevent contamination. Fill the sterile container with the sampled water and then seal. Take care to confirm that the sample container is sealed properly and does not leak. Label the container with a unique identifier, the date and time the sample was taken and the analysis that is required.
9. Place laboratory samples on ice in a cooler for analysis of bacteria and pollutants of concern.
10. Fill out chain-of-custody form for laboratory samples, including the unique identifier, date, time, sample matrix, sampler's initials, and required test information. The chain of custody form will remain with the samples at all times.

11. Conduct in-situ field tests using the remaining water in the grab container. Use test strips, test kits, and field meters (rinse similar to dipper) for most parameters (see **Table 6-3**). All results will be recorded.
12. Samples will remain on ice until they are accepted by the laboratory. Samples must be analyzed by the laboratory within 8 hours of their collection. Any violation of this hold time is required to be documented in the laboratory's final report.
13. Upon completion of all sampling, or portion of sampling as the 8 hour bacteria hold time allows, deliver the samples to the laboratory identified in the Health and Safety Plan (HASP) Appendix A: Individual Site Pre-Sampling Safety Plan. The samples must be signed over to the laboratory using the chain of custody form. Retain a carbon copy of the chain of custody from while the original remains with the samples. Follow the handling and chain of custody procedures described in the following section.
14. Dispose of used test strips and test kit ampules properly.
15. Decontaminate all testing personnel and equipment, following HASP guidance.

6.2.3.1 Field Kits

Field test kits or field instrumentation are permitted for all parameters except indicator bacteria and some pollutants of concern. Field kits need to have appropriate detection limits and ranges. **Table 6-3** 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 E**.

Testing for indicator bacteria and any pollutants of concern must be conducted using analytical methods and procedures found in 40 CFR § 136.[5] Samples for laboratory analysis must also be stored and preserved in accordance with procedures found in 40 CFR § 136. Methods will vary by laboratory. **Table 6-4** lists analytical methods, detection limits, hold times, and preservatives for laboratory analysis of dry weather sampling parameters.

[5] 40 CFR § 136: http://www.ecfr.gov/cgi-bin/text-idx?SID=b3b41fdea0b7b0b8cd6c4304d86271b7&mc=true&node=pt40.25.136&rgn=div5

Table 6-3 Sampling Parameters and Analysis Methods

Analyte or Parameter	Instrumentation (Portable Meter)	Field Test Kit
Ammonia	CHEMetrics™ V-2000 Colorimeter Hach™ DR/890 Colorimeter Hach™ Pocket Colorimeter™ II	CHEMetrics™ K-1410 CHEMetrics™ K-1510 (series) Hach™ NI-SA Hach™ Ammonia Test Strips
Surfactants (Detergents)	CHEMetrics™ I-2017	CHEMetrics™ K-9400 and K-9404 Hach™ DE-2
Chlorine	CHEMetrics™ V-2000, K-2513, I-2001 Hach™ Pocket Colorimeter™ II	NA
Conductivity	CHEMetrics™ I-1200 YSI Pro30 YSI EC300A Oakton 450 Oakton PCTSTestr 50	NA
Temperature	YSI Pro30 YSI EC300A Oakton 450 Oakton PCTSTestr 50	NA
Salinity	YSI Pro30 YSI EC300A Oakton 450 Oakton PCTSTestr 50	NA
pH	YSI Pro30 YSI EC300A Oakton 450 Oakton PCTSTestr 50	NA
Indicator Bacteria: *E. coli* (freshwater) or Enterococcus (saline water)	EPA certified laboratory procedure (40 CFR § 136)	NA
Pollutants of Concern[6]	EPA certified laboratory procedure (40 CFR § 136) or approved field meter	NA

[6] 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.

Table 6-4 Required Analytical Methods, Detection Limits, Hold Times, and Preservatives

Analyte or Parameter	Analytical Method	Detection Limit	Max. Hold Time	Preservative
Ammonia	Direct Nesslerization	0.05 mg/L	28 days	Cool ≤6°C, H_2SO_4 to pH <2, No preservative required if analyzed immediately
Surfactants	Methylene Blue	0.01 mg/L	48 hours	Cool ≤6°C
Chlorine	DPD	0.02 mg/L	Analyze within 15 minutes	None Required
Temperature	N/A	N/A	Immediate	None Required
Specific Conductance	N/A	0.2 µs/cm	28 days	Cool ≤6°C
Salinity	N/A	-	28 days	Cool ≤6°C
Indicator Bacteria: *E. coli* *Enterococcus*	*E. coli* **EPA**: 1603 **SM**: 9221B, 9221F , 9223 B **Other**: Colilert ®, Colilert-18® *Enterococcus* **EPA**: 1600 **SM**: 9230 C **Other**: Enterolert®	*E. coli* **EPA**: 1 cfu/100mL **SM**: 2 MPN/100mL **Other**: 1 MPN/100mL *Enterococcus* **EPA**: 1 cfu/100mL **SM**: 1 MPN/100mL **Other**: 1 MPN/100mL	8 hours	Cool ≤10°C, 0.0008% $Na_2S_2O_3$
Total Phosphorus	**EPA**: Manual-365.3, Automated Ascorbic acid digestion-365.1 Rev. 2, ICP/AES4-200.7 Rev. 4.4 **SM**: 4500-P E-F	**EPA**: 0.01 mg/L **SM** : 0.01 mg/L	28 days	Cool ≤6°C, H_2SO_4 to pH <2
Total Nitrogen*	**EPA**: Cadmium reduction (automated)-353.2 Rev. 2.0, **SM**: 4500-NO_3 E-F	**EPA**: 0.05 mg/L **SM**: 0.05 mg/L	28 days	Cool ≤6°C, H_2SO_4 to pH <2

SM = Standard Methods

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

6.2.4 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. The challenge with this method can be finding appropriate durations of dry weather and the need for multiple trips to each manhole.

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 6-5** 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 6-5 Benchmark Field Measurements for Select Parameters

Analyte or Parameter	Benchmark
Ammonia	>0.5 mg/L
Conductivity	>2,000 µS/cm
Surfactants	>0.25 mg/L
Chlorine	>0.02 mg/L (detectable levels per the 2016 MS4 Permit)
Indicator Bacteria: *E. coli* *Enterococcus*	E. coli: 235 cfu/100ml Enterococcus: 104 cfu/100ml

According to the 2016 MS4 Permit Part 2.3.4.7c.ii, likely sewer input indicators are any of the following:

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

6.4 Follow-up Ranking of Outfalls and Interconnections

DCR 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, summarized in each annual report and will be completed within three (3) years of the effective date of the permit (June 30, 2021).

Outfalls/interconnections where relevant information was found indicating sewer input to the MS4 or sampling results indicating sewer input are highly likely to contain illicit discharges from sanitary sources. Such outfalls/interconnections will be ranked as Problem Outfalls for follow-up 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.

7.1 System Vulnerability Factors

While DCR does not generally own sewer systems, where available DCR 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, if readily available:

- Plans related to the construction of the DCR drainage network;
- Plans related to the construction of the sewer drainage network on DCR property; and
- Prior work on the DCR storm drains or sewer lines on DCR property.

The presence of the following **System Vulnerability Factors (SVFs)** may be identified for each catchment, as available:

- Crossings of storm and sanitary sewer alignments where the sanitary system is shallower than the storm drain system;

- 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 shared by sanitary sewer owners/ operators and shared with DCR; or
- Sewer pump/lift stations, siphons, or known sanitary sewer restrictions where power/equipment failures or blockages could readily result in SSOs, as identified by sanitary sewer owners/ operators and shared with DCR.

A SVF inventory will be documented for each catchment, retained as part of this IDDE Plan, and included in the annual report. **Table 7-1** is an example of the inventory which will be documented.

Table 7-1 Outfall Catchment System Vulnerability Factor (SVF) Inventory

		1	2	3
Outfall ID	**Receiving Water**	**Storm/Sanitary Crossings (Sanitary Above)**	**Sanitary Infrastructure Defects**	**SSO Potential In Event of System Failures**
Sample 1	XYZ River	Yes/No	Yes/No	Yes/No

Presence/Absence Evaluation Criteria:

1. Crossings of storm and sanitary sewer alignments where the sanitary system is shallower than the storm drain system
2. 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
3. Sewer pump/lift stations, siphons, or known sanitary sewer restrictions where power/equipment failures or blockages could readily result in SSOs

7.2 Dry Weather Manhole Investigations

DCR 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 Division of Engineering 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 catchment layer development and 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.

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.
2. If flow is observed, a sample will be collected and analyzed at a minimum for ammonia, chlorine, and surfactants. 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. If flow is not observed, an obstruction (sandbag) will be placed in the manhole to capture intermittent flows. After at least 48 hours of dry weather, the sandbag will be checked. If flow is captured, then it will be sampled and analyzed for the same parameters.
4. 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.
5. Subsequent key junction manhole inspections will proceed until the location of suspected illicit discharges or SSOs can be isolated to the shortest segment of pipe possible, ideally a single pipe between two manholes. Should inspections proceed to the edge of the DCR system and/or a perceived municipal interconnection to the DCR MS4 without identifying the location of suspected illicit discharges or SSO source, the investigator will note the potential source and follow DCR's Drainage Disconnection Policy for alerting the owner of the upstream system.
6. If no evidence of an illicit discharge is found, catchment investigations will be considered complete upon finishing review/sampling of key junction manholes.
7. If a minimum of one (1) System Vulnerability Factor (SVF) is identified based on previous information or this catchment investigation, DCR will flag this outfall for a wet weather investigation in the database.

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 Division of Engineering 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 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 provided in **Section 6**.
2. Wet weather sampling will occur during or after a storm event of sufficient depth or intensity to produce runoff. Wet weather sampling decisions will be at the discretion of the sampling team. Wet weather screening will be conducted if there is at least 0.25 inches of rainfall, or enough rain to induce runoff. Field crews will sample within 24 hours after the rainfall event. Field crews will strive to sample during active rain as much as possible. 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.

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) will be developed as they are needed.

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. The challenge with this method can be finding appropriate durations of dry weather and the need for multiple trips to each manhole.

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

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

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

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 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 communication devices, such as cell phones or 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 when an active flush with sewage entering into the drain is visible, it can be costly and time consuming when compared to other source isolation techniques. When an active flush is not visible, follow-up with dye testing to confirm illicit connections will be needed.

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 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.

Public notification is an important aspect of a detailed source investigation program. Prior to smoke testing, dye testing, or TV inspections, the Division of Engineering will notify visitors with temporary signage in the vicinity of the testing and/or inspections.

7.5 Illicit Discharge Removal

When the specific source of an illicit discharge is identified, DCR 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; and
- 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.

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.

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** . 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;
- Status of on-going investigations of suspect flows and source identification;
- Estimate of the volume of sewage removed, as applicable; and
- Number of employees trained annually.

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

Appendix A – Impaired Receiving Waters and Impairments

DCR MS4 Receiving Waters and Impairments

Water Body Name	Segment ID	Category	Impairment(s)	Associated Approved TMDL

Category 4a Waters – impaired water bodies with a completed Total Maximum Daily Load (TMDL).
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.
"Approved TMDLs" are those that have been approved by EPA as of the date of issuance of the 2016 MS4 Permit.

Appendix B – Illicit Drainage Disconnection Policy

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Appendix C – Outfall and Interconnection Inventory and Priority Ranking

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Outfall Inventory and Priority Ranking Matrix

Last Revision Date: 6/25/2019

Outfall ID	Receiving Water		Reports or Complaints of Potential Illicit Discharges?[1]	Discharging to Area of Concern to Public Health?[2]				Receiving Water Quality[3]	TMDL Watershed[4]	Density of Generating Sites with Catchment[5]	Score	Priority Ranking
Information Source			Town/Agency Records	a	b	c	d	Impaired Waters List	Mass DEP	Agency Records		
Scoring Criteria			Yes = 40 (Problem outfall) No = 0	Yes = 6 No = 0				Bacteria = 6 Other = 2 None = 0	Yes = 2 No = 0	Yes = 3 No = 0		Problem => 40 High Priority => 6 Low Priority < 6
Sample 1	MA##-##	XYZ River	40	6	6	0	0	2	0	3	57	Problem
Sample 2	MA#####	XYZ Lake	0	0	0	6	0	6	0	3	15	High Priority
Sample 3	MA##-##	XYZ Stream	0	6	6	0	0	0	2	0	14	High Priority
Sample 4	MA##-##	XYZ River	0	0	0	0	0	2	0	3	5	Low Priority

Scoring Criteria:

[1] Previous reports of dumping, failing septic systems, odors, or other indications of potential illicit discharges.

[2] Outfalls/interconnections that discharge to or in the vicinity of any of the following areas, as determined via GIS evaluation of the following data layers. Note: Discharges to an area of concern to public health will automatically be considered High Priority.

- Public Beaches: https://docs.digital.mass.gov/dataset/massgis-data-marine-beaches
- Recreational Areas (note: query layer for only PRIM_PURP = "R" to only review areas protected for recreation primarily): https://docs.digital.mass.gov/dataset/massgis-data-protected-and-recreational-openspace
- Surface Water Supply Watersheds: https://docs.digital.mass.gov/dataset/massgis-data-public-water-supplies
- Shellfish Beds: https://docs.digital.mass.gov/dataset/massgis-data-designated-shellfish-growing-areas

[3] Receiving water quality based on latest version of MassDEP Integrated List of Waters: https://www.mass.gov/lists/integrated-lists-of-waters-related-reports

- Bacteria: Discharges to waters or their tributaries listed as impaired for bacteria (Category 4a or 5 Waters). This may include waters impaired for Fecal Coliform or Escherichia coli. Note: Discharges to bacteria impaired waters will automatically be considered High Priority, based on guidance provided in Appendix H of the 2016 Permit
- Other: Discharges to waters or their tributaries listed as impaired for pollutants other than bacteria (Category 4a or 5 Waters). This does not include waters impaired for non-pollutants.
- None: Discharges to waters or their tributaries with no water quality impairments (Category 2 or 3 Waters)

[4] Discharges to waters with an approved TMDL where illicit discharges have the potential to contain the pollutant identified as the cause of the impairment. Listing of approved TMDLs can be found here: https://www.mass.gov/lists/total-maximum-daily-loads-by-watershed

[5] Density of generating sites based on DCR internal knowledge

- Yes = DCR Labor yard or fueling area within 1,000 feet of the outfall
- No = No known high pollutant generating sites within 1,000 feet of the outfall

Appendix D – Field Equipment Checklist

Field staff can use the following checklist to ensure adequate equipment before field sampling. Items can be added or removed at the discretion of the field sampling team.

Appendix D – Field Equipment Checklist

Testing Equipment Checklist		
Check	**Equipment**	**Use/Notes**
	Ammonia test strips (or kits)	Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day
	Chlorine test strips (or kits)	Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day
	Surfactants test kit	Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day
	Photometer	For chlorine test kit, as needed
	Conductivity, salinity, pH and temperature meter	Handheld meter, if available, for testing for various water quality parameters such as ammonia, surfactants and chlorine and if needed, for sampling conductivity, temperature, pH

Sampling Equipment Checklist		
Check	**Equipment**	**Use/Notes**
	Mobile data collector (tablet)	Collect dry weather inspection and dry weather sampling results
	Map with sampling location and Facility ID's (if not using tablet)	For orientation
	GPS receiver (tablet or handheld GPS)	For taking spatial location data
	Clipboard (if not using tablet)	For organization of field sheets and writing surface
	100 ml pre-labeled laboratory bacteria sample bottles (bacteria)	Make sure all sample containers are clean. Keep extra sample containers on hand at all times. Make sure there are proper sample containers for what is being sampled for (i.e., bacteria requires sterile containers).
	500 ml pre-labeled laboratory bacteria sample bottles (other laboratory analysis)	
	125 ml pre-labeled laboratory sample bottles (for on-site testing and BBAC off-site testing)	
	Additional sample containers as needed	
	Data sheet and chain of custody forms	Field sheets for both dry weather inspection and dry weather sampling should be

Sampling Equipment Checklist		
Check	**Equipment**	**Use/Notes**
		available with extras. Chain of custody form is needed to ensure proper handling of all samples
	De-ionized water or laboratory purified water and extra bottles as necessary	For sample procedures
	Pens, pencils, and/or permanent markers	For proper labeling
	Label tape	For labeling sample containers
	Sampling pole, dipper, sampling cage, and/or hand-held vacuum pump	For accessing hard to reach outfalls and manholes
	Disinfecting (wet) wipes and/or hand sanitizer	Disinfectant/decontaminant

Sample Transport Checklist		
Check	**Equipment**	**Use/Notes**
	Coolers	For transporting samples to the laboratory
	Frozen blue ice, ice, and/or cold packs	

Tools Checklist		
Check	**Equipment**	**Use/Notes**
	Flashlight and/or headlamp with extra batteries	For looking in outfalls or manholes, helpful in early mornings as well
	Manhole hook (from local DPW)	For opening manholes
	Measuring tape and/or carpenters' ruler	Measuring distances and depth of flow
	Shovel (from local DPW)	For opening, propping, prying as needed
	Pry bar or pick	For opening catch basins and manholes when necessary
	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
	Zip ties and/or duct tape	Field repairs
	Safety glasses	Personal Protective Equipment (PPE). Staff should review the project-specific Health and Safety Plan (HASP) for a complete list of PPE.
	Safety vests	
	Rubber knee boots and/or waders for accessing shallow streams/areas	
	Safety (traffic) cones	Safety

Other Checklist		
Check	**Equipment**	**Use/Notes**
	Bug spray (the CDC recommends products with: DEET (exposed skin and clothing) or Permethrin (on clothing)	Protection
	Poison ivy wash (e.g., Tecnu, Zanfel)	Protection (especially if allergic to poison ivy)
	Water (drinking water quality)	For drinking, washing as needed
	Digital camera (smartphone or tablet)	For documenting field conditions at time of inspection
	Field log books	Documentation
	Nitrile gloves	To protect the sampler as well as the sample from contamination
	Paper towels	Cleaning
	Sealable bags	Miscellaneous storage, organization

Additional Equipment (as needed)		
Check	**Equipment**	**Use/Notes**
	Safety equipment, such as a face covering, for compliance with State of Massachusetts COVID-19 guidelines	Staff should review the project-specific Health and Safety Plan (HASP) for a complete guidance on COVID-19 guidelines.

Appendix E – Water Quality Sampling Equipment User Manuals

Appendix E – Water Quality Sampling Equipment User Manuals

Appendix F – IDDE Employee Training Record

Appendix F – IDDE Employee Training Record

Illicit Discharge Detection and Elimination (IDDE)

Employee Training Record

Date of Training: _____

Duration of Training: _____

Name	Title	Signature

Appendix F – IDDE Employee Training Record