Town of Westford

Stormwater Sampling Manual

WOODARD &CURRAN

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ACKNOWLEDGMENTS

Woodard & Curran would like to acknowledge the Charles River Watershed Association for their outstanding work and research regarding stormwater sampling procedures. Much of the content contained in Field Safety Procedures - Section 5 and the Sampling Procedures - Section 7, can be attributed to the Charles River Watershed Association's *Water Quality Monitoring Manual* (2012). See References for a full list of reference documents.

1. PURPOSE & SCOPE

The Town of Westford is dedicated to clean and safe water for its citizens and for the welfare of the natural resources within its boundaries. The Town is not only responsible for providing clean drinking water but also for ensuring that stormwater runoff from town drainage systems is not contributing to unsafe conditions for people or the environment.

The Town of Westford is responsible for maintaining compliance with the Clean Water Act and is currently regulated under what is known as the Municipal Separate Storm Sewer System (MS4) General Permit. This permit authorizes stormwater-only discharges from the Town's drainage system but these discharges cannot cause or contribute to the degradation of the environment or create unsafe conditions for people. The MS4 permit requires specific investigation of stormwater drainage system discharges to ensure environmental and public health.

This stormwater sampling manual is intended to provide guidance to staff and volunteers as they support the Town's efforts in monitoring its stormwater discharges. The manual focuses on sampling equipment, procedures, and tests typically used to monitor for leaks or overflows from sanitary sewer or septic systems into the drainage system; these leaks of overflows are called illicit discharges. The manual also discusses sampling for pollutants in stormwater runoff that may contribute to the pollution of lakes and ponds but it is NOT a comprehensive guide for sampling all water bodies. The purpose of this Training Manual is to provide staff and volunteers with the understanding and skills needed to efficiently conduct stormwater runoff sampling from Town drainage systems consistent with MS4 general permit requirements.

WHAT IS AN ILLICIT DISCHARGE?

The Environmental Protection Agency defines an illicit discharge as "any discharge to an MS4 that is not composed entirely of stormwater"; exceptions are discharges regulated by a separate National Pollution Discharge Elimination System (NPDES) permit and non-stormwater discharges considered allowable by the MS4 General Permit.

Illicit discharges can enter the drainage system via direct connections or indirect discharge, defined as follows:

- A **direct connection** is any non-stormwater pipe mistakenly or deliberately connected to the storm drain system, such as a pipe from a washing machine or floor drain, overflow pipe from a septic system, or a sewer service connection from a house. Often, these types of discharges are continuous; and

- An **indirect discharge** may come from a wide variety of sources, such as sanitary sewer overflows, infiltration into the drainage system from failed septic systems, or hazardous waste spills collected by catch basins. Grass clippings, leaf litter, and other solid material dumped or otherwise deposited in the storm drain system are also considered indirect illicit discharges. These are commonly intermittent or transitory discharges and can be difficult to track or monitor.

Illicit discharges are problematic because unlike wastewater that flows to a wastewater treatment facility, stormwater generally flows through a drainage system directly into waterways without any treatment. Illicit discharges often include pathogens, nutrients, surfactants, and various toxic pollutants and sanitary wastewater systems incorrectly connected to the storm drain can create numerous human health problems if people come in contact with the water.

WHAT ARE PERMITTED NON-STORMWATER DISCHARGES?

The MS4 general permit specifically allows certain types of non-stormwater discharges if they do not cause or contribute to water quality problems. Examples of allowable non-stormwater discharges are listed below. The Town has assessed these non-stormwater discharges and determined the following sources of non-stormwater discharges are not significant contributors of pollution entering or leaving the Town's stormwater drainage system.

1. Water line flushing,
2. Landscape irrigation,
3. Diverted stream flows,
4. Rising ground waters,
5. Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20)),
6. Uncontaminated pumped ground water,
7. Discharge from potable water sources,
8. Foundation drains,
9. Air conditioning condensation,
10. Irrigation water, springs,
11. Water from crawl space pumps,
12. Footing drains,
13. Lawn watering,
14. Individual resident car washing,
15. Flows from riparian habitats and wetlands,
16. Dechlorinated swimming pool discharges,
17. Street wash water, and
18. Residential building wash waters, without detergents.

WHY DOES MONITORING FOR ILLICIT DISCHARGES MATTER?

Illicit discharges are not permitted under the MS4 general permit nor under local regulations and if they are identified and unresolved they can result in violations and fines for MS4 operators. When these pollutants enter water bodies, they can contaminate drinking water supplies, create harmful swimming or boating conditions, and harm wildlife habitats.

The goal of the Town of Westford's Illicit Discharge Detection and Elimination (IDDE) Program is to identify potential illicit discharge contamination entering the City's storm water drainage system and to remedy the direct or indirect connection. The sampling program described herein is intended as a preliminary screening process with follow up activities described in the Town of Westford IDDE Plan.

Typically, the screening process will look at municipally-owned stormwater discharge points, a.k.a. outfalls during:

- **Dry Weather Conditions -** This effort is intended to find direct illicit connections which would likely contribute flow (sewage or washing machine discharges during dry weather).

  Dry weather conditions shall only proceed when no more than 0.1 inches of rainfall has occurred in the previous 24-hour period as specified in the the Draft New Hampshire (NH) Small MS4 General Permit (2013). The draft NH MS4 General Permit is referenced because it is the most recent version of the MS4 permit to be drafted and reissued at the time of this publication. These requirements are likely to be included in next generation Massachusetts (MA) MS4 General Permit.

- **Wet Weather Conditions –** This effort is to identify potential illicit discharges only occurring or triggered during rainfall events, such as sanitary sewer or septic backups and overflows caused by excessive rainfall or high groundwater.

  During or immediately following a storm even capable of producing runoff greater than 0.1 inches.

The sampling process for identification of illicit discharges will generally consist of documenting visual observations (i.e. looking for obvious signs of sewage contamination), notable smells, and simple field and/or

laboratory testing for ammonia, chlorine, conductivity, pH, surfactants (byproducts in detergents), temperature, and turbidity. These "indicators" are not necessarily conclusive of an illicit discharge but are considered by EPA to provide indications that further illicit discharge investigation into the storm drain system is warranted. Sampling locations may vary from year to year but priority areas for outfall sampling are identified in the Town's IDDE Plan and include stormwater outfalls located on the maps located in Appendix A and listed in the stormwater sampling location table in Section 2 (Table 2). Further description of dry weather and wet weather monitoring is located in Appendix F.

WHAT ABOUT OUR PONDS, LAKES, AND OTHER WATER BODIES?

Lakes and ponds in Westford are priority areas for illicit discharge sampling because they have a high recreation and environmental value. Freshwater lakes and ponds are particularly sensitive to excessive nutrients found in sewage and will accelerate the eutrophication process (i.e. growth and die-off of algae, which affects available oxygen levels). Illicit discharges into ponds may also contribute to elevated levels of bacteria, viruses, and pathogens that can contribute to unsafe conditions for swimming or other water-related recreational uses.

Additionally, the State of Massachusetts identifies water bodies that are "impaired" due to various pollution sources and updates the list every 2 years. This impairment status creates additional management requirements in the MS4 general permit. The following table summarizes water bodies with identified impairments and their likely sensitivity to particular pollutants.

Table 1: Impaired Waters – 2012 Integrated List of Impaired Waters

Waterbody Name	Impairment	Pollutant
Forge Pond	Non-Native Aquatic Plants Mercury in fish tissue(Total maximum daily load (TMDL) study completed for mecury in fish tissue)	Nutrient / Eutrophication Biological Indicators Turbidity Escherichia Coli Phosphorous (total) Mercury
Nabnasset Pond	Non-Native Aquatic Plants, Mercury in fish tissue (TMDL study completed for mercury in fish tissue)	Mercury
Beaver Brook	Low dissolved oxygen levels (Assessment for biological indicators of impacts)	TSS Escherichia Coli Phosphorous (total) Organic Enrichment (sewage) Biological Indicators
Stony Brook	Aquatic Macroinvertebrates Habitat Impacted(Bioassessment studies to assessextent of impacts)	Escherichia Coli Turbidity
Deep Brook	Habitat and Aquatic Macroinvertebrate Impacts	Escherichia coli Sedimentation/Siltation
Heart Pond	Water quality in pond diminished	Escherichia coli
Nashoba Brook	Low flow alterations (Conduct bioassessments to evaluate impacts)	

2. WESTFORD STORMWATER SAMPLING LOCATIONS

The following table identifies priority stormwater sampling locations in Westford, MA. This table provides the address of a property located adjacent to the stormwater outfall sampling location (for driving directions) and a unique identification number for each outfall. The notes are special instructions, warnings, or comments about each outfall location. Maps of each of the following locations are found in Appendix A.

Table 2. Westford Stormwater Sampling Site Locations

Watershed	Site #	Nearest Adjacent Address	Notes
Watershed A.	Insert Unique Outfall ID here		
	2		
	3		
	4		
	5		
	6		
Watershed B.	7		
	8		
	9		
	10		
	11		

3. STORMWATER SAMPLING PROGRAM MANAGEMENT

The Town of Westford's stormwater sampling program organizational structure and lines of communication are as follows:

1. Paul Starratt (Town Engineer/ Program Manager) ↔ Town Staff

2. Jeremy Downs (Assistant Town Engineer/ Field Sampling Program Coordinator) ↔ Contractors, Town Volunteers, Operations Staff

Note to Town:

1. If the Town is going to maintain ongoing contract with sampling laboratory, their contact numbers should be listed here as well.

2. Ideally a workflow process diagram would go here to describe how the program works (i.e. map updates, sampling container acquisition, sampling location dropoff and delivery, analysis, QA/QC, etc). We can develop after training presentation if needed.

Table 3. Stormwater Sampling Program Key Contact Information

Name	Contact Name	Phone	Address
Town of Westford Engineering Department		978- 692- 5520	28 North St, Westford, MA 01886
Town Engineer / Program Coordinator	Paul Starratt, P.E.		
Field Sampling Program Coordinator	Jeremy Downs		
General Emergency		911	
Fire Department		978- 692- 5542	
Police Department		978- 692- 2161	
Nearest Hospital	Tewksbury Hospital	(978) 851-7321	365 East St. Tewksbury, MA 01876
Poison Control Center		1- 800- 222- 1222	
On-Site First Aid			
Local Emergency Planning Committee			

4. PUBLIC RELATIONS

PUBLIC NOTICE

Citizen sensitivity to activities by a public agency, the sight of municipal utility crews on private properties, and reoccurring presence of crews on sites can trigger complaint calls. Therefore, public notification is essential to implementing and maintaining an effective stormwater sampling program and can help to promote accountability and meet MS4 permit requirements.

It is important for the public to understand the reasons that stormwater sampling is conducted. These reasons include:

- location and prevention of stormwater pollution,
- prevention of groundwater contamination, and
- improved water quality which leads to safer and healthier waters.

An effective program should consist of both notification and education during field operations. Adequate notice should be given whenever possible using a variety of means to ensure adjacent property owners, and the public at large, are informed of monitoring programs. For a municipality the size of Westford, we recommend the following methods of public notification:

- Town Website - Ongoing Notice
- Neighborhood postings for adjacent property owners (via direct mail/phone, reverse 911 or other means) at least 48 hours prior to sampling
- Newspaper notice with start and end date, contact information, and any possible inconveniences the sampling may cause. See example notification in Appendix B.

Those directly affected by the sampling such as land owners adjacent to priority outfalls or potential emergency responders, should be adequately notified prior to and when the sampling takes place. A list of existing affected persons, if any, should be reviewed annually and updated as necessary for inclusion in this manual.

PUBLIC OUTREACH THROUGH SAMPLING PROGRAM

To accomplish the education component of the public relations program, the Town of Westford should adopt and make available a set of Frequently Asked Questions (FAQs). The questions and answers should be posted on the Town website and also made available for handout at the Engineering Department. Sampling crew members should carry the FAQs in the field while conducting sampling to be distributed to members of the local community upon request.

It is imperative that positive relations with citizens are maintained during the sampling program. Sampling crews should be mindful of public perception and support a polite and cooperative environment. Care must be taken not to impede progress of construction projects, pedestrian walkways and traffic, or other land use. Crews must be made aware of their environment and make sure the sampling is not destructive to personal property, such as landscaping and gardens, animal habitats, etc.

5. FIELD SAFETY PROCEDURES

The Town of Westford volunteer and staff safety is an integral part of Westford's Stormwater Sampling Program. Useful data that advance the program will ONLY be acquired under safe conditions.

Please read the following safety precautions carefully prior to field efforts. The Town of Westford will conduct safety trainings for field crews on an annual basis prior to sampling season (spring of each year) and safety reminders (i.e. tail gate sessions) during each field effort.

GENERAL SAFETY PRECAUTIONS

Table 4. Standard Operating Safety Procedures

Hazard	Standard Operating Procedure
Heat Stress	Wear breathable protective clothing. Take frequent breaks in hot weather and ensure that you have adequate amount of drinking water on hand.
Slips/trips/falls	Personnel will wear boots or waders that provide suitable mobility and traction.
Drowning	Personnel will not enter fast-flowing water that is greater than knee-deep.
Caught-in Mud	Personnel will not enter into areas of thick or deep mud along shorelines where it is possible to be stuck. Test all areas with pole/stick prior to entering.
Confined Space Entry	Permitted for trained employees only. No volunteer or untrained staff will enter a confined space. **Confined space** is a term from labor-safety regulations that refers to an area which is enclosed with limited access which make it dangerous. An example is the interior of a storage tank, manhole, culvert, which workers may enter for maintenance but which is not ordinarily a habitable space.
Insects – General Hazards	Personnel will wear long-sleeved shirts and pants during fieldwork. Insect repellant will be applied prior to field work and reapplied as needed throughout duration of work.
Mosquitos	DEET – recommended mosquito repellent. 50% concentration recommended reapplication as needed.
Wasps & Bees	Remain calm; try not to disturb nest areas. If stung, remove stinger with tweezers or other blunt object (such as credit card) against sting site.
Ticks	Wear light-colored protective clothing such as long sleeve pants, shirts & head coverings. Tuck pants into socks and tape at seam to keep ticks away from skin. Wear permethrin-based gators or spray onto clothes and shoes to repel ticks (do not apply directly to skin). Do a thorough tick-check following field-based work.
Noxious Plants (poison ivy, poison oak, poison sumac)	Personnel will wear long-sleeved shirts and pants during fieldwork. Use commercially available pre-contact skin protectant towelettes or barrier cream. Exposed skin will be washed as soon as possible with dish soap & water or commercially available post exposure scrub wash products to remove the oil. Use gloves to remove exposed clothes & shoes. Seek medical attention if conditions worsen.

WORKING ON, OVER, OR NEAR WATER

In the event of any work over or near water, it is important to exercise due care around water hazards. If employees and/or volunteers will be working over or near water where a risk of drowning could occur (per OSHA ≥ 2 feet deep), then employees and volunteers must take the following precautions:

- Employees/Volunteers must be provided with and use United States Coast Guard (USCG) approved personal flotation devices (PFDs, i.e., life jackets).
- Before and after each use, inspect the PFDs for defects.
- Provide ring buoys with at least 90 feet of line if working from a boat or skiff.

NOISE EXPOSURE / HEARING CONSERVATION

Hazardous noise levels are ubiquitous on construction sites. Noise sources typically include the engines and/or motors of the equipment, the operating parts of the equipment, compressed air, and other components. Noise-induced hearing loss (NIHL) is insidious and often occurs before one notices it. Hearing protection devices (HPDs) including ear plugs and/or muffs may be required if sampling near construction sites.

WEATHER-RELATED HAZARDS

In addition to heat and cold temperatures, weather-related hazards should be anticipated and appropriate protective measures must be taken. Given the multi-season work schedule and unpredictable New England weather, adverse weather should be anticipated. Always check the weather forecast for the site locale before heading out. The following are some possible weather-related hazards and protective measures:

Lightning

Do not work during electrical storms. Stay off high areas (e.g., top of the landfill) and hazardous areas (e.g., on water) that attract lightning.

Snow

Snow squalls, whiteouts, blizzards, and nor' easters: Do not schedule work when weather reports indicate potential snowstorm watches or warnings. Send personnel home early in advance of an approaching storm.

Hurricane / Tornado

Take appropriate shelter. Do not schedule work when weather reports indicate potential hurricane or tornado watches or warnings. Send personnel home early in advance of an approaching storm.

Hail

Take appropriate shelter. Do not schedule work when weather reports indicate potential hail watches or warnings.

Flash Flooding

Take appropriate shelter. Do not schedule work when weather reports indicate potential flash flooding watches or warnings. Have workers vacate low-lying areas and seek higher ground. Do not attempt to navigate across flooded areas or waterways.

REAGENTS FOR FIELD TEST KITS

The handling of certain reagents may be required for field test kits, such as test kits for Surfactants and test kits using Chlorine colorimeter. When handling and use is required, ensure that the user has reviewed the Safety Data Sheet, is aware of the associated hazards and first aid measures, and that the appropriate personal protective equipment is selected and used.

TRAFFIC AWARENESS

Employees and/or volunteers may work in areas that are in close proximity to roadways, parking lots, or associated with the highway infrastructure (e.g., bridges, tunnels). Personnel may be exposed to hazards both inside and outside the work zone. Depending on the specific project and work task, this may include the risk of injury from passing motor vehicle traffic as well as the potential risk from the movement of construction vehicles and equipment near the work zones.

When working alongside of roadways, the following general precautions should be observed:

1. Locate a safe place to park vehicles for each sampling site.
2. If practical, park vehicles between on-coming traffic and work area to serve as a warning barricade and to protect workers on foot from reckless drivers.
3. Use temporary traffic control (TTC) devices, such as cones, signage, warning devices, barricades and similar whenever necessary based on the type and location of work to be performed, the duration of operations, time of day, the characteristics of the roadway, and/or the volume and speed of traffic.
4. Wear a **minimum of Class 2 high visibility safety apparel at all times during sampling.** The "American Standard for High-Visibility Safety Apparel" [ANSI/ISEA 107] specifies three classes of safety apparel:
    i. *Class 3*: These garments provide the highest level of conspicuity for workers. These are for workers with high task loads in a wide range of weather conditions where traffic exceeds 50 mph.
    ii. *Class 2*: These garments are for workers who work near roadways where traffic exceeds 25 mph and need greater visibility in inclement weather.
    iii. *Class 1*: These garments are worn by workers where traffic does not exceed 25 mph and there is ample separation from the traffic.
    iv. For those projects where Class 2 apparel is not adequate (e.g., working in a wide range of weather conditions where traffic exceeds 50 mph), employees will be required to wear Class 3 safety apparel.
    v. Inspect high-visibility clothing regularly to ensure that color has not faded and that reflective properties have not been lost.
5. If working under poor lighting conditions, consider using fluorescent garments with reflective material.
6. Consider the use of high-visibility arm bands and/or hats, or vest with strobes to increase visibility.
7. Be aware that additional personal protective equipment (PPE) may be required based on the hazards of the work task.

Bridges

Always use extreme care when sampling at the edge of a bridge. Test railing firmly before leaning out over them. DO NOT CLIMB onto railings or bridge abutments. If your samples are too heavy to lift up over a railing, fill only one sample bottle at a time.

SAMPLING EQUIPMENT SAFETY

pH, Ammonia, Chlorine, and Surfactant Test Kits

Keep test kits and test strips in a cool dry place. Avoid contact with water/ moisture until individual test strip is to be used for sampling. Carefully read and abide by all instructions and safety warnings on the test kit before use.

Sampling Pole

The sampling pole must be kept a minimum of 10 ft. from power lines at all times. Neither end of the sample pole should ever be raised more than 2 ft. above the sampler's head. As detailed in the instructions below, the sampling pole should be raised and lowered by first extending the length of the pole horizontally in front of you and then slowly lowering or raising the collecting end down to, or up from, the sampling location. Prior to deploying the sampling pole, visually scan your surroundings to identify the location of all power lines. **If the sampling pole cannot be safely deployed, do not collect a sample.**

The sampling pole should always be transported in the non-extended position. Even in the non-extended position care must be taken not to bump people or property with the sampling pole. Carry the pole in the horizontal position (parallel to the ground) by gripping the pole in the middle. Please be extra-aware of your surroundings when transporting the sampling pole.

Never raise the end of the pole more than 2 ft. above the sampler's head, therefore the pole must be raised and lowered by extending the pole out horizontally. This requires an adequate radius to maneuver the pole in the horizontal direction. Ensure that your sampling site has enough space for the sampling pole to be properly deployed without hitting any obstacles. Additionally, you may find it necessary to walk backwards with the sampling pole to bring the samples to the shore, always look behind you before walking backwards and always walk backwards parallel to roadways. Do not back up into the roadway, unless you have a partner to make sure the area is safe, watch for traffic, and direct you.

Over extending a sampling pole can cause the sampling pole to break. The sampling pole should never be extended beyond its maximum extension. Most sampling poles have an indication noting maximum extension.

Manholes & Catch Basins

When removing manhole and catch basin covers, use extreme caution. These covers are very heavy require a pick or lifting device and can crush fingers and toes. If sampling sites indicate the need to sample in manholes or catchbasins (see notes on Table 2) steel-toed boots should be worn. During sampling, always have a partner to supervise the sampling process as well as watch for and direct traffic if needed. Make sure all traffic in both directions has plenty of visual warnings and traffic cones/ signs to alert drivers of crew members on and along the roadway.

Lifting

Always use proper lifting techniques when in the field. Never lift more than you are capable of lifting. There are three reasons for most back injuries from lifting.

1. **Size of the load** – load may be more than your back can handle. Never underestimate the size of a load.

2. **Amount of strength** – know when you can lift safely. Never overestimate your strength.

3. **How you lift** – in order to reduce the risk of back injury, when lifting, avoid back movements that involve twisting, jerking, awkward positions, and quick or rough movements.

Lift the proper, safe way every time. When performing lifting tasks, follow these basic rules:

1. First, test the weight of the load by tipping it. If in doubt, ask for help. Do not attempt to lift a heavy load alone.
2. Take a good stance. Plant your feet firmly with legs apart, one foot farther back than the other. Make sure you stand on a level area with no slippery spots or loose gravel, etc.
3. Get a firm grip. Use as much of your hands as possible, not just your fingers.
4. Keep your back straight, almost vertical. Bend at the hips if you bend.
5. Hold load close to your body. Keep the weight of your body over your feet for good balance.
6. Use large leg muscles to lift. Push up with the foot positioned in the rear as you start to lift.
7. Lift steadily and smoothly. Avoid quick, jerky movements.
8. Avoid twisting motions. Turn the forward foot and point it in the direction of the eventual movement.
9. Never try to lift more than you are accustomed to.
10. Always get help when you have to lift bulky loads.

6. STORMWATER SAMPLING EQUIPMENT

GENERAL SAMPLING EQUIPMENT NEEDS

- ✓ Clean sample container (i.e. small plastic / glass beaker) to hold water samples being tested using test kits
- ✓ Sampling Lab Containers for samples to be delivered to the laboratory
- ✓ Five pound bags of ice if samples to be sent to lab;
- ✓ Paper towels
- ✓ Mobile table or working station
- ✓ EPA approved cleaning / disinfecting agent. (Rubbing alcohol based cleaning agent) for the end of the extension pole, if used.
- ✓ Distilled water for decontamination of end of extension pole if used
- ✓ Commercial hand disinfectant
- ✓ Waste container and plastic baggies for holding used testing strips
- ✓ Reclosable, transparent container for holding liquid waste materials (methylene blue) (i.e. Nalgene water bottle, ziplock bag)
- ✓ Watch for recording observation time
- ✓ Field notebook for observation
- ✓ Inspection Forms
- ✓ Pen/pencil and permanent marker
- ✓ Tape for labeling
- ✓ Nitrile gloves
- ✓ Utility knife
- ✓ Flashlight and appropriate batteries
- ✓ Tape measure
- ✓ Traffic safety cones
- ✓ Reflective vest/jacket
- ✓ Cooler for transporting sample bottles
- ✓ Extension pole sampler
- ✓ Digital camera for documentation
- ✓ Pry bar or pick for manhole or catch basin removal
- ✓ Sandbags
- ✓ 50’ cord
- ✓ Safety Glasses and other applicable Personal Protection Equipment

TEST KITS

Each kit should be provided to Town Program staff. Before use, read and follow by all instructions and safety warnings on all labels and test kits. Improper use could lead to bodily harm and injury. Understand how to use each testing kit before entering into the field for sampling.

Chlorine Testing Strips

For best results, store chlorine testing strips in a cool dry place with no exposure to moisture as this will ruin the strips. Carefully read all instructions and abide by all safety-warning labels.

Figure 1. Hach – 'AquaCheck' Water Quality Test Strips for Total and Free Chlorine.

Ammonia Testing Strips

For best results store Ammonia testing strips in a cool dry place with no exposure to moisture as this will ruin the strips. Carefully read all instructions and abide by all safety-warning labels.

Figure 2. Hach – 'AquaCheck' Water Quality Test Strips for Ammonia.

SurfactantsTesting Kit

For best results, store the surfactants testing kit in a cool, dry, dark place. Carefully read all instructions and abide by all satefy-warnings. Use extreme caution when using testing materials to avoid skin and eye contact as well as inhilation or ingestion of testing substances. Properly dispose of all used testing materials in a sealed container.

Figure 3. CHEMetrics Detergents Testing Kit.

Thermometer

Remove thermometer from packaging / casing and make sure air temperature reading seems reasonably accurate. Place thermometer directly in pooling water at outfall if possible. If there is no pooling for thermometer reading, fill sample container cup with outfall water and submerge tip of thermometer in the water. Allow for the thermometer reading to stabilize and record temperature reading.

pH & Conductivity Testing

The Town of Westford maintains and uses a YSI Professional Plus Meter for PH and Conductivity. Refer to Appendix D for use and calibration of this piece of equipment.

Figure 4. YSI Professional Plus Conductivity meter

Turbidity Testing

Gather small sample of water from outfall in designated jar for the turbitimeter. Make sure to wipe off the outside of the jar to remove all fingerprints and other materials. Correctly place the jar in the turbitimeter and run program. Record reading for turbidity and repeat one or more times for precision.

E. Coli & Phosphorus Testing

Collect the water sample directly from the outfall into associated laboratory sample containers provided by the laboratory that will be conducting the analyses. Alpha Analytical is located nearby and will drop off containers and pick up samples at the end of the day. Deliver sampling containers with stormwater samples to the laboratory or sample drop off location. Typical hold time for bacteria is no more than 6 hours. The holding time for phosphorus is 28 days with acid addition. Be sure to allow enough time to drop off the samples at the lab or to have them ready for the courier that will take them there.

Note: In the event that the outfall is inaccessible to get close enough to collect the sample directly into sample containers, attach the container to the end of the extension pole and position the bottle directly under the outfall for sample collection being careful not to overfill. For each outfall inaccessible to sample directly into laboratory sampling container (see Section 2), request from the lab an extra clean unpreserved 500 mL plastic sample container.

7. SAMPLING PROCEDURES

KEY DEFINITIONS

Dipper Sampler: Consists of a sampling pole often as long as 10 feet long with a cup on the end used to gather stormwater sample directly from outfall or from within a manhole. Should only be used if bacteria samples are not planned on being collected, since most decontamination methods are not completely effective.

Extension Pole Sampler: This is basically the same as a dipper except that instead of a cup at the end of the pole, there is a screw or cable tie that secures the sample container directly to the pole itself. A pole that can extend out to approximately 10 feet that is equipped with a fastener at the end to attach a sample container. Once the container is secure on the end of the pole, the pole can be moved into position at the outfall to collect the sample This sampler can be used in lieu of the dipper sampler if bacteria samples need to be collected.

Sample Bottle: Plastic bottle, small bucket, or plastic container used to collect water samples from which smaller samples will be taken to be tested for chlorine, ammonia and surfactants field test kits. (Dipper or extension pole sample can be used to pour stormwater directly into sample bottle or preferably the sample can be collected directly into the sample bottle). It is imperative that only clean laboratory containers are used for bacteria sampling. Intermediate sample bottles should not be used between sampling locations.

Laboratory Container: Containers provided by the lab to be used to hold and transport the water samples to the laboratory from the sampling field site. Different sized containers will be used for each parameter. For the bacteria and phosphorus analyses, the containers will contain a thiosulfate pill and sulfuric acid, respectively. Containers and a cooler in which to store the samples will be provided by the laboratory before sampling is to be conducted and should be stored in a location where they will stay clean and dry. Be sure to request from the lab an extra clean unpreserved 500 mL plastic sample container for each outfall sample location inaccessible by grab sampling alone. In this case the sample will be collected in the clean 500 mL plastic bottle and then transferred into the lab sample containers containing preservatives.

Testing Container: Small plastic or glass beaker or container used to hold small amounts of water for performing field tests such as using the test strips for chlorine, surfactants and ammonia detection. (Water will be transferred from the dipper or extension pole sampler into th testing container.) **Do Not** pour testing water back into sample bottle or combine with other samples as this could cross-contaiminate the water samples.

GENERAL SAMPLING PROCEDURES

All observations are recorded in the stormwater sampling field notebook(s) with a pencil or ballpoint pen. (Pencil works best if the pages are wet.) This is the permanent record of the field observations and is kept intact by the observer. Pages should not be torn from this notebook. All of the information from the field notebook is copied onto the data sheet. This data sheet is turned in to the Field Sampling Program Coordinator with the sample/s to be brought to the laboratory for analysis.

Each day's observations begin on a fresh sheet of paper. The following information should be recorded for each monitoring event:

- Site Name and Number
- Observers
- Date
- Time

- Weather
- Other general observations or notes on access difficulties or other pertinent information

SET-UP PROCEDURES

On the night prior to sampling:

1. **Notification:** Be sure to notify the Field Sampling Program Coordinator of your plans to be out sampling the next day.

2. **Bottles and Laboratory Containers:** Organize sample bottles and laboratory containers. Make sure that lab container is marked with your site number and the sampling date. Use a sharpie permanent marker to label anything necessary. Bottles for the future sampling will be distributed when you drop off the current samples. Keep them in a safe place until the appropriate time. Be sure that the location from which the sample is being collected matches the identification on the bottle (i.e. don't grab the wrong bottle when you are out sampling.)

3. **Ice:** Prepare a bag of ice, or a freezer "ice pack," and store it in your freezer.

4. **Paperwork:** Fill out as much of your notebook entry and data sheet as possible, including date and location. The more you can fill out the night before, the easier your task will be in the morning.

5. **Equipment Check:** Check through your equipment to be sure that you have everything and that it is all in good working order (e.g. test your flashlight). Place all equipment, including the sample bottles and labels that you will use the next day, data sheets, notebook, contact information for Field Sampling Program Coordinator personnel, etc., in a large container to facilitate carrying it all.

DRY AND WET WEATHER MANUAL GRAB SAMPLE GENERAL PROCEDURES FOR EACH OUTFALL

1. Identify appropriate location of outfall. Observe outfall. Ensure that free draining discharge from outfall is available for sampling. Do not enter water below outfall as disturbance of sediments may skew sampling results.

2. As needed, conduct visual and olfactory inspection procedure for evidence of illicit discharge. Complete IDDE Inspection Form

3. All samplers should put on nitrile gloves prior to collected samples..

4. If discharge is flowing freely from the outfall and is accessible, fill the sample bottle and/or laboratory containers directly at the outfall discharge point.

5. If discharge from outfall is submerged under water move, upstream to nearest manhole or catch basin (this should be noted in figures in Appendix A). If storm drain location is on the street, ensure safe access within non-traffic location, and use a pry bar to open manhole or catchbasin cover. If sampling within a storm drain and sufficient water depth is not available for grab sample, use cord to carefully lower sandbag to block outlet pipe temporarily so that stormwater will form a small pool. Allow water to clear of obvious sediments if disturbed during placement of sandbag. This should only be necessary during dry-weather sampling events. Use dipper or extension pole sampler to collect stormwater directly from the pool or flow of water within the manhole or catch basin structure.

6. Make sure that the dipper or extension pole sampler is clean and has been decontaminated before grabbing a sample. As necessary, decontaminate the dipper receiving cup and testing container with an

EPA approved or alcohol based disinfectant, then rinse with distilledwater Rinse over grass surface away from stream or water body.

DO NOT USE A SOAP BASED CLEANER AS THIS WILL CONTAMINATE THE WATER SAMPLES.

7. A dipper or extension pole sampler can be used if it is not possible to collect a sample without disturbing the bottom sediment or to get close enough to the outfall to allow samples to be collected directly into sample bottles and laboratory containers.

    a. Ensure that the extension handle (if applicable) is screwed in tightly and the adjustable orange mega cuffs are attached securely to prevent any parts from becoming detached while collecting your sample. (Most sampling poles have a ring indicating the point that the sampling pole should never be extended beyond.)

    b. If you are sampling from a bridge, estimate the distance down to the outfall, extend the telescoping pole enough so that the sample can be collected just below the lip of the outfall. **The sampling pole should always be extended horizontally, never straight up.**

    c. Raise the pole by lifting the sampling end until the pole is extended horizontally out in front of you, rotate the sampling end to your left or right and then slowly walk backwards, parallel to the roadway, until the sampling end is resting on the bridge. Or, if you're on the bank, carefully back up with the pole, until the sampling end of the pole is over land and can be safely accessed by you or your sampling partner. **Check your surroundings before you rotate the sampling pole or back up so that neither you nor the pole bump into or trip over any obstacles. Do not raise the pole in a vertical position; neither end of the pole should ever extend more than 2 ft. above the sampler's head.**

    d. Extend the sampling pole horizontally out in front of you, then lower the sampling end down so that the mouth of the bottle(s) is in the center of the outfall or outfall channel, gently submerge the bottle(s) below the water's surface. Observe bottle(s) closely to ensure that it does not touch bottom sediments. If it does, note this fact in the field notebook and field data sheet.

8. Remove the lid(s) of the sample bottle(s) or laboratory container without touching the inside the bottle(s) or lid(s). Place the lid(s) face up until the bottle(s) is ready to be sealed.

9. Rinse the dipping container or end of the sampling pole in the outfall water by dipping it in the water three (3) times. Take care not to disturb the bottom sediment when conducting this triple rinse.

10. Once the dipper, sample bottle or laboratory container is filled, carefully lift it from the water by raising the sampling end until it is extended horizontally out in front of you. While raising the sampling pole or dipper, avoid knocking the container against any vegetation or structures so the water sample does not become cross-contaminated.

Figure 5. Removing Filled Dipping Container from manhole.

11. Depending on test or sample you are obtaining (A) Transfer sample into a laboratory container or testing container for test strip or surfactant analysis or (B) Place the sample bottles on a sturdy surface and secure the lid(s) to the top of the bottle(s). A new sampling bottle may be required for bacteria samples or the sample can be transferred to a clean testing container for test strip analysis.

12. Check that the cap(s) is tightly secured on the sampling bottle(s). Make sure your site number and sampling date are noted on the sample bottle. Use the permanent marker supplied if necessary.

13. Note the exact time of sample collection in your field notebook and datasheet.

14. Place the lab container(s) for transport to the laboratory on ice immediately.

15. Repeat steps if more sampling bottles or lab containers need to be filled.

16. Decontaminate the dipper container and testing containers with an EPA approved or alcohol based disinfectant then rinse with distilled water prior to moving to next sampling site.

17. Do not use the dipper or any other transfer container for the collection of bacteria samples. If rthe outfall has water flowing freely from the end of the pipe, use the extension pole sampler to collect this sample by attaching the prepreserved laboratory container on the end of the pole and fill directly from end the pipe. In the event that the outfall is submerged and there is a possibility of losing the preservatives in the laboratory containers, attach a clean unpreserved 500 mL plastic bottle (provided by the laboratory but not used for any analysis and to be used only to transfer stormwater into laboratory containers) to the end of the pole. Fill the bottle using the steps described in the previous steps then transfer the stormwater into the appropriate laboratory containers.

- **When collecting any type of stormwater sample it is imperitive that the sample is collected before the stormwater reaches the receiving water.**
- **Also, a new, clean pair of gloves should be worn when testing a new sample and especially when moving to a different outfall as dirty gloves could cause contamination of water samples and distort results.**

Figure 6. Sampling directly from outfall using dipper..

Bacteria Sampling Procedure

Laboratory containers should be ordered from the laboratory several days prior to the samplilng event. The outfall samples will be specifically tested for E. coli. The laboratory container will have a thiosulfate tablet in the bottom of the bottle. Transfer the sample from sample bottle to lab container and fill to 100 mL fill line for bacteria analysis. Be careful not to overfill the container and/or lose the thiosulfate tablet. As described on the previous page, do nto use the dipper sampler for collection of these samples. Fill laboratory containers directly from the outfall or use the extension pole sampler to fill a clean 500 mL container to transfer water into laboratory containers using the sample bottle based on accessibility to the outfall. Place the container into a cooler filled with ice.

Phosphorus Sampling Procedure

Total phosphorus analysis is conducted by the laboratory. Laboratory containers contain sulfuric acid as a preservative. Care should be taken not to lose the acid out of the bottle. Sample collection procedures are thus focused on methods that will prevent the loss of the sulfuric acid. Place bottle under the outfall discharge pipe and allow bottle to be filled directly . Use procedure described above for the extension pole sampler in the event that the outfall is not easily accessible. Fully fill the preserved laboratory container with sample without letting water overflow the bottle to prevent loss of the acid. .

pH / Conductivity / Turbidity / Temperature Procedure

1. Place pH/conductivity/temperature probe(s) into sample in Testing Container and allow readings to stabilize for a couple of minutes.
2. Fill glass cuvette to white filling line and place in turbidity meter. Record turbidity reading.
3. Record pH, conductivity and temperature readings.

Ammonia Test Strip Procedure

Fill Testing Container with water sample. Place test strip into water for 30 seconds. Compare strip pads with corresponding color designations on the testing strip bottle. Record ammonia concentration.

Figure 7. Ammonia Test Strip procedure.

Chlorine Test Strip Procedure

Fill Testing Container with water sample. Place test strip into water for 30 seconds. Compare strip pads with corresponding color designations on the testing strip bottle. Record chlorine concentration.

Surfactants Test Kit Procedure

Fill reaction tubes, add reagents and follow instructions in test kit to get surfactants concentration. Record the concentration.

Always decontaminate the Testing Container and other sampling equipment with an EPA approved or alcohol based disinfectant then rinse with distilled water upon conclusion after samples are collected at each outfall location.

Figure 9. Surfactant testing procedure.

Testing Containers may be reused for Ammonia and Chlorine testing procedures with same sample volume.

DEPARTURE

Check carefully around your site prior to departing to be sure that you do not leave behind any equipment or trash. Be sure that all samples are stored in a cooler with ice. If this is the final sampling location proceed to sample drop-off site. Always allow enough time to deliver samples to the laboratory.

FOLLOW-UP PROCEDURES

Bring your samples directly to the collection site. For bacteria samples, time is critical as all samples need to be collected, cross checked and delivered to the lab within six hours of sampling. Hand your sample(s) **and** data sheet to the Field Sampling Program Coordinator, or deposit them in the appropriate containers located at the collection site. Sign the chain of custody form.

Report any complications to the person at the collection site and to your Field Sampling Program Coordinator. Inform your coordinator of any lost or broken equipment so s/he can replace it prior to the next sampling. Please also note any broken or needed equipment on your data sheet.

PASSIVE SAMPLING PROCEDURE

Passive sampling of stormwater runoff may be required (or more efficient) in some instances and the following description has been provided for use under these circumstances.

Passive sampling procedures may be particularly useful to capture wet weather events and the "First Flush". First Flush is the first runoff that reaches a sampling location and may have a disproportionately high concentration of contaminants making it important for sampling. Passive sampling may also be useful for collecting transitory dry weather discharges such as those created by washing machine illicit connections.

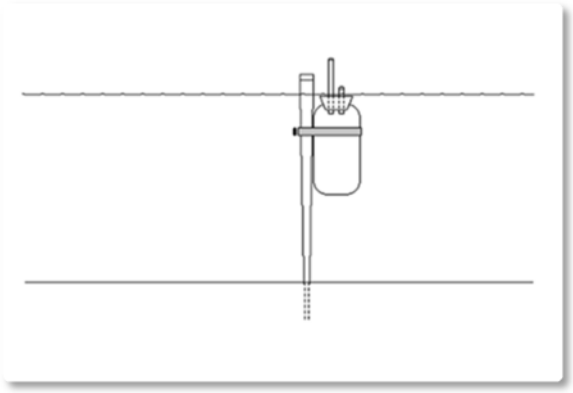

Figure 8. Passive Surface Water Sampler for sampling 'First Flush' (above).

First flush storm water can be collected using a fixed passive sampling device that is designed to sample conveyance water during the rising limb of a hydrograph. This device consists of a laboratory cleaned sample bottle fixed to a pole within the drainage channel. The bottle is held upright, with two tubes of unequal length extending out of the top of the bottle. Passive stormwater samplers can also be purchased through vendors (http://www.coleparmer.com/assets/literature/99159-XXBrochure.pdf).

During a precipitation event, the first flush of runoff enters the shorter tube, while the taller tube lets air out of the bottle (Figure 10). These devices are placed downgradient of storm water conveyances to capture storm water discharge and the sampling tube is positioned so that very little increase in flow is needed to fill the bottle. This

requires an understanding of the particular sampling location and some creativity in installation. Post-storm samples are collected shortly after the precipitation event ends or on a schedule for dry weather sampling.

During the post-storm sampling, first flush sample bottles are retrieved. Sample bottles are placed in an ice-filled cooler and deliverd directly to a certified water quality laboratory or dropped off at the sample collection drop-off location.

Figure 9. Passive Sampler Set-Up Procedure (above).

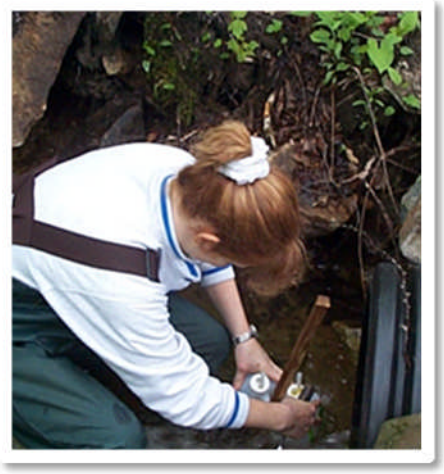

Figure 10. Passive Sampler Set-Up Procedure (above).

Figure 11. Sampling outfall using Passive Sampler (above)

QUALITY CONTROL SAMPLING PROCEDURES

Field Duplicates

Field duplicates are taken at two to four sites during each sampling year for phosphorus and bacteria samples (one duplicate per ten samples), the location of which is constantly rotated. Field duplicates indicate sampling precision and are taken to show reproducible field sampling procedures. The procedure for taking field duplicate samples is as follows:

Field Duplicate Sampling Procedure

1. Collect first sample(s) in the sampling device as usual.
2. Collect field duplicate(s) in the using the same sample collection method. The regular sample and field duplicate should be taken during two separate grab samples.
3. Repeat until all sample bottles and field duplicate bottles are filled.
4. Make sure all lids are secure on sampling bottles and bottles are labeled with site number and sampling date. Field duplicate bottles will also be labeled as field duplicates.
5. Immediately put the samples on ice and implement follow-up procedures.

8. DATA EVALUATION

LAB ANALYTICAL METHOD REFERENCES

The following are laboratory references for each of the sample parameters discussed in this manual. The test kits are useful for preliminary screening but additional laboratory analysis may be necessary for conclusive sampling, field duplicates or other components of a Quality Assurance Project Plan (QAPP).

Table 5. Laboratory Analytical Methods

Parameter	Standard Method	Minimum Detection Limit	Resolution
pH	EPA 150.1	0 Std Units	0.01 Std Units
Conductivity	EPA 120.1	1.5 µS/cm	0.3 µS/cm
Turbidity	EPA 180.1	0.1 NTU	0.01 NTU
Total phosphorus	EPA 365.1	0.010 mg/L	0.002 mg/L
Dissolved phosphorus	EPA 365.1	0.010 mg/L	0.002 mg/L
Ammonium nitrogen	EPA 350.1	0.010 mg/L	0.002 mg/L
Nitrate nitrogen	EPA 353.2	0.010 mg/L	0.003 mg/L
Total nitrogen	EPA 353.2 with SM 4500NC	0.05 mg/L	0.01 mg/L
Bacteria	EPA 1103.1; 1603	4col. / 100mL	

DATA EVALUATION AND INTERPRETATION

As previously stated , the sampling program described in this manual is intended to be a preliminary screening to begin the process of identification of illicit discharges. The following table provides interpretation of results of the test methods discussed and levels of pollution concentration. These parameters should be looked at as a whole and individual high levels of pollutant concentration may not be sufficient indicator to warrant additional investigation. These references are described from the EPA New England Bacterial Source Tracking Protocol (Draft January 2012) and also from best professional judgment and experience in the field.

Table 6. 'Threshold Levels for determination of illicit discharges'

Test	EPA Benchmark	Concentration Levels Indicating Need for Further Investigation	Remarks
E. coli	> 235 E. coli/100 mL	>4000 E. Coli/100 mL	Undiluted wastewater will generally have *E. coli* levels an order of magnitude or more higher than the EPA benchmark. Pet waste, wildlife sources and regrowth of bacteria in storm drains have been shown to contribute to elevated *E. coli* levels above the benchmark.

Test	EPA Benchmark	Concentration Levels Indicating Need for Further Investigation	Remarks
Ammonia	> 0.5 mg/L	>0.5 mg/L	In the absence of other wastewater indicators, follow-up investigation is performed when the ammonia concentration is 0.5 mg/L or higher. If other wastewater indicators are present, then a 0.25 mg/L benchmark is used. Decomposing vegetation under anoxic conditions can release ammonia to water, which can be misleading.
Surfactants	>0.25 mg/L	>0.25 mg/L	Detection of low concentrations (0.1-0.3 mg/L) of surfactants is common at stormwater outfalls. Most detections are not correlated with other wastewater indicators and do not lead to a definite source. These detections may be attributable to outdoor vehicle or building washing.
Total chlorine	> Reporting Limit	>0.50 mg/L	The field test used for total chlorine analysis is sufficiently sensitive to detect municipal potable water sources diluted by groundwater or runoff approximately 3 to 10 fold, depending on the strength of the potable chlorine residual and type of chlorination used. Total chlorine is a decent indicator of treated drinking water leaks and potentially graywater sources, but may also be permitted non-stormwater discharges. If high levels are consistently identified in a sample without other wastewater indicators, such as bacteria or ammonia, then discussions with water utility should precede comprehensive investigation of drainage area.
Specific conductance	N/A	>600 µS/cm	Specific conductance alone is not a reliable indicator of wastewater contamination. Road salt and metals from pipe corrosion often result in levels in the 1,000-5,000 µS/cm range. However, flows contaminated with wastewater generally have specific conductance above 600 µS/cm. Very high level (>5,000 µS/cm) may indicate an industrial illicit connection.

Test	EPA Benchmark	Concentration Levels Indicating Need for Further Investigation	Remarks
Total Phosphorus	N/A	>0.3 mg/l	Phosphorus alone is not a reliable indicator of wastewater sources. High levels of phosphorus may be present in stormwater discharges due to erosion in the drainage area or other natural sources. Treated drinking water may also be high in phosphorus to meet anti-corrosion requirements in drinking water distribution systems and may be identified during dry weather sampling if a water line flushing activity or other drinking water discharge is present in the storm drain system.

Temperature and turbidity are not reliable indicators of wastewater alone as stormwater runoff can contain contribute to increases in temperature and turbidity but in combination with the other sampling parameters may be an indication of an illicit connection. Low temperature may indicate a groundwater source as opposed to illicit source.

9. REFERENCES

Charles River Watershed Association. (2012). *Water Quality Monitoring Manual (17th ed.).* Weston, MA: CRWA.

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Stone Environmental Inc. (2013). *Stone's IDDE Experience.* Montpelier, VT: Stone Environmental Inc.

Sullivan, Richard K. Jr. "Massachusetts Year 2012 Integrated List of Waters". *Commonwealth of Massachusetts*. 2013.

Woodard & Curran. (2011). *Water Distribution System: Flushing Program for Fort Myers Beach.* Portland, ME: Woodard & Curran.

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Appendix A. Outfall Site Maps

Appendix B. Example Notice to Public.

The following Public Advertisement can be run in the local newspaper and local access television.

> "The Town of Westford, Massachusetts Water Department is conducting routine stormwater sampling throughout Town starting on ____ and expected to finish around ____. If there are stormwater outfalls or manholes on your property, you may experience the presence of crew members sampling stormwater. Their presence should only last a short period of time and there will be no change in your water system. Feel free to notify crew members with possible concerns you may have about your property or water system. Please contact the Water Department at _____, or go to the Town web site to view the sampling site map and Frequently Asked Questions concerning Westford's Stormwater Sampling Program".

Appendix C. Example Outfall Sampling Field Sheet

Westford Stormwater Sampling Field Sheet

Watershed: _____

Site #: _____

Street Location: _____

Date: _____/_____/_____ **Time of Arrival:** _____:_____

Weather: _____ **Air Temp:** _____

Observers: _____ _____

_____ _____

Collection Period: Wet [ ] Dry [ ]

Flow Present: Yes [ ] No [ ]

Flow Description: Light [ ] Moderate [ ] Substantial [ ]

Lab Grab samples

Phosphorous Yes [ ] No [ ]
Bacteria Yes [ ] No [ ]

Intermittent flow trap set (i.e. sandbag): YES [ ] NO [ ]

FIELD DATA COLLECTION			
PARAMETER	**RESULT**	**UNIT**	**EQUIPMENT**
Chlorine		mg/L (ppm)	Test strips
Ammonia		Mg/L (ppm)	Test strips
Surfactants		Mg/L (ppm)	Detergents test kit
Conductivity		S/m	Conductivity meter
Water Temperature		°F	Thermometer

Are There Any Physical Indicators Present in the flow? ☐ **Yes** ☐ **No (If NO, skip table)**

INDICATOR	CHECK if Present	DESCRIPTION	RELATIVE SEVERITY INDEX (1-3)		
Odor	☐	☐ Sewage ☐ Rancid/sour ☐ Petroleum/gas ☐ Sulfide ☐ Other:	☐ 1 – Faint	☐ 2 – Easily detected	☐ 3 – Noticeable from a distance
Color	☐	☐ Clear ☐ Brown ☐ Gray ☐ Yellow ☐ Green ☐ Orange ☐ Red ☐ Other:	☐ 1 – Faint colors in sample bottle	☐ 2 – Clearly visible in sample bottle	☐ 3 – Clearly visible in outfall flow
Turbidity	☐	See severity	☐ 1 – Slight cloudiness	☐ 2 – Cloudy	☐ 3 – Opaque
Floatables -Does Not Include Trash!!	☐	☐ Sewage (Toilet Paper, etc.) ☐ Suds ☐ Petroleum (oil sheen) ☐ Other:	☐ 1 – Few/slight; origin not obvious	☐ 2 – Some; indications of origin (e.g., possible suds or oil sheen)	☐ 3 - Some; origin clear (e.g., obvious oil sheen, suds, or floating sanitary materials)

NOTES:

_____

_____

_____

_____

_____

_____

_____

_____

Appendix D. Calibration steps for YSI Professional Plus

CONDUCTIVITY CALIBRATION

1. Make sure probes are rinsed with D-H_20 and pat dry. *Hint: we think blowing on the openings at top of probe may help.*
2. Fill long plastic tube with Conductivity calibration solution — 1000uS/cm. Make sure holes at top of probe are covered with solution (near yellow tape).
3. Press CAL button.
4. Select **Sp Conductivity &** press enter.
5. Select C-uS per cm (NOT mS)
6. Select Calibration value then select enter.
7. Select 1000 value then hit enter at bottom of number selection.
8. *Hint: if you get a Results Questionable/Out of Range message, you may need to clean this probe with brush and D-H_20. Rinse probe & pat dry.*
9. Turn off meter. Wet sponge in grey cap then drain off. Attach metal probe guard. Cover with grey cap.

Hint: small metal tube at top of probe measures temperature

NOTES

- Make sure date and time on the meter is accurate.
- Make sure to check battery status before using.

pH — Calibration at pH 4.0, 10.0&7.0

STEP 1

1. Take off bottle of pH 4.0 calibration solution from meter probe, cover with regular cap and place in storage bag. Take off screw cap with gasket carefully from probe. *Hint: Screw off cap with gasket of pH 4.0 bottle clockwise so don't accidently disconnect pH probe.*
2. Rinse off conductivity & pH probes with D-H_20. *Hint: conductivity probe has 2 large holes on top. pH probe has glass bulb on bottom.*
3. Turn on ProPlus meter
4. Pour some pH 4.0 buffer into container (cover temp probe). Place in large beaker so it will stand alone for calibration.
5. Press CAL (Calibration button).
6. Scroll down to ISEI (pH).
7. Calibration value = 4.0
8. Accept Calibration. Look at bottom of screen, will see **"Ready for Point 2".**

STEP 2

1. Rinse probe with D-H_20, pat dry. Repeat Step 1 for pH 10.0. If calibration value does not equal 10.0, then change this to 10.0 by selecting calibration value. Step through Ws then hit enter. Accept calibration.
2. Will then see **"Ready for Point 3"** at bottom of screen.

STEP 3

1. Rinse with D-H_20 & pat dry. Repeat Step 1 for pH 7.0. Rinse with D-H_20 then pat dry.
2. Press CAL to finish = this will accept ALL Calibrations.
3. Cap 7.0 solution and save for field Calibration check on day of sampling.

YSI PRO-ODO Probe - Calibration Protocol

1. Connect Pro-ODO unit to its cable. Make sure the numbers on the unit match the number on the cable.
2. Check current air pressure in local area (we use Hanscom/Bedford Airport) using the NOAH (National Oceanic and Atmospheric Administration) website at http://www.noaa.gov
3. Find the barometric pressure -for example, today the Barometer value is 29.63 in (inches of mercury)

   Use this formula: ([Hg value] x 25.40) - 5.0 = current air pressure

   for example, today we calculated [30.28]x 25.40 - 5.0 = 764 mmHg as our current air pressure
4. Take red cap off Oxygen Probe (ODO). Rinse off Oxygen probe with distilled H2O (d-I-120) then pat dry with clean paper towel,
5. Take grey plastic tube cap (make sure sponge is on inside bottom). Add some d-H20 to sponge to wet, then pour off excess.
6. Screw on metal protector for probe (has black lines).
7. Put on the grey rubber cap but leave it so holes at top of probe are exposed (so it can equilibrate with the air).
8. Place probe on clamp (on stand). Let sit for at least 5-10 minutes.
9. While this is equilibrating, start calibrating the other meters for pH and Conductivity.
10. Press CAL button. Press DO. Press DO% (this is the first choice on the list).
11. Confirm Barometer reading. If this is not accurate, you will need to adjust the barometer by selecting barometer on the menu.
12. Accept calibration, press enter.
13. Turn off unit. Take probe off stand, then put cover on all the way.

Appendix E. Frequently Asked Questions (FAQ)

Appendix F. Dry & Wet Weather Conditions

As referenced from 2013 Draft NH MS4 Permit. Section 3: *OUTFALL MONITORING PROGRAM*

http://www.epa.gov/region1/npdes/stormwater/nh/Draft-NH-Small-MS4-Permit.pdf

DRY WEATHER SCREENING AND ANALYTICAL MONITORING

Dry weather outfall screening shall proceed only when no more than 0.1inches of rainfall has occurred in the previous 24-hour period. The permittee must conduct dry weather screening on a minimum of 25 percent of the outfalls each year of the permit beginning in the second year of the permit with completion by the end of the permit term. When a flow is observed at an outfall, a sample of the flow shall be collected and analyzed.

The permittee must document the number of outfalls screened and any monitoring results each year in the SWMP and the annual report. Dry weather screening can be conducted at the same time the permittee conducts the outfall inventory required in Part 2.3.4.6(d).

Dry weather discharges shall be analyzed for: ammonia, chlorine, conductivity; E.Coli. or enterococcus (as appropriate depending on whether a discharge is to a fresh water or a marine water); pH; potassium; surfactants (as MBAS); temperature and turbidity. The permittee must identify the source of any dry weather discharge and must identify any necessary follow-up actions consistent with the protocol required by Part 2.3.4.6(d).

If the discharge is directly into an impaired water, the permittee must also monitor for the pollutants identified as the cause of the impairment provided an analytical method in 40 CFR 136 exists for that pollutant.

If the pollutant identified as the cause of the impairment is present in the discharge, the permittee shall also undertake efforts designed to identify the source(s) of the pollutant(s) and implement measures to eliminate it. The permittee must document the procedures in the SWMP and annual report.

If no dry weather flow is observed at the outfall, the permittee shall record the location of the outfall, the condition of the outfall and other relevant information. See Part 2.3.4.6(d) of the permit. If no flow is observed, but evidence of flow exists, the permittee must revisit the outfall during dry weather within one week of the initial observation, if practicable. The permittee must identify in the SWMP and annual report any necessary follow-up provisions to identify the source flow

WET WEATHER ANALYTICAL MONITORING

The permittee must conduct wet weather analytical monitoring of all outfalls and at interconnections with another MS4. Wet weather monitoring does not require a minimum rainfall event. Monitoring can occur for any storm event of sufficient intensity to produce a discharge.

The permittee must conduct wet weather analysis on a minimum of 25 percent of the outfalls each year of the permit beginning in the second year of the permit with completion by the end of the permit term. This 25 percent must be the same outfalls that are monitored for dry weather to the extent practicable. If it is not practicable, the permittee shall explain why in the next annual report. The permittee must document the number of outfalls monitored and monitoring results each year in the annual report.

Wet weather flows shall be monitored for the following parameters: conductivity; E.Coli or enterococcus (as appropriate depending on whether a discharge is to fresh water or marine water); chlorine; potassium; ammonia; pH; surfactants (as MBAS); temperature; and turbidity.

If the discharge is directly into an impaired water, the permittee shall monitor the outfall for the pollutant(s) identified as the cause of impairment provided an analytical method in 40 CFR 136 exists for that pollutant.

If the pollutant identified as the cause of impairment is present in the discharge, the permittee shall develop procedures for the control measures in Part 2.3 designed to minimize or eliminate the pollutant. The permittee shall also undertake efforts designed to identify the source(s) of the pollutant(s) and implement measures to eliminate it. The permittee must document the procedures in the SWMP and report in the annual report.

The permittee must maintain all records associated with the monitoring program consistent with the requirements of Part 5.2.1.