3.6 MS4 Outfall Pipe mapping, Illicit Discharge Detection and Elimination, and Stream Scouring

This permit condition has three components: Outfall Pipe Mapping, Illicit Discharge Detection and Elimination, and Stream Scouring Detection and Control. The Tier A Municipality is required to develop, update and maintain an outfall pipe map showing the location of the end of all MS4 outfall pipes (tidal and non-tidal) owned or operated by the Tier A Municipality that discharge to a surface water body. The Tier A Municipality is required to develop, update and implement a program to detect, investigate and control any localized stream scouring from stormwater outfall pipes owned or operated the municipality. In addition, the Tier A Municipality must develop, update and implement an ongoing Illicit Discharge Detection and Elimination Program. Along with the program to detect and eliminate illicit discharges, the municipality must adopt and enforce an ordinance that prohibits illicit discharges to the Tier A Municipality's MS4.

Below, and on the following page, is a summary table of the minimum standards, measurable goals and implementation schedule of this SBR

MS4 Outfall Pipe Mapping, Illicit Discharge Detection and Elimination, and Stream Scouring SBR			
		Implementation Schedule	
Minimum Standard	**Measurable Goal**	**Existing Permittees**	**New Permittees**
Develop, update and maintain an MS4 Outfall Pipe Map showing the location of the end of all outfall pipes which discharge to a surface water body.	Certify annually	January 1, 2018	EDPA + 36 months
Show the location (and name where known) of all surface water bodies receiving discharges from those outfall pipes.	Certify annually	January 1, 2018	EDPA + 36 months
Include Outfall Pipe map in the SPPP.	Certify annually	January 1, 2019	EDPA + 36 months

Note: EDPA means effective date of permit authorization.

MS4 Outfall Pipe Mapping, Illicit Discharge Detection and Elimination, and Stream Scouring SBR (*cont'd.*)			
		Implementation Schedule	
Minimum Standard	**Measurable Goal**	**Existing Permittees**	**New Permittees**
Provide Outfall Map to the Department.	Certify annually	January 1, 2019	EDPA + 36 months
Submit the Outfall Pipe Map information to the Department electronically by December 21, 2020.	Submit the Outfall Pipe Map on or before the deadline	December 21, 2020	EDPA + 36 months
Develop, update and implement a program to detect, investigate and control localized stream scouring from stormwater outfall pipes.	Certify annually	January 1, 2019	EDPA + 60 months
Develop, update, implement and enforce an ongoing Illicit Discharge Detection and Elimination Program.	Certify annually	January 1, 2018	EDPA + 60 months
Adopt and enforce an ordinance that prohibits illicit connections to the MS4 operated by the Tier A Municipality.	Certify annually; SPPP records retention	January 1, 2018	EDPA + 12 months

Note: EDPA means effective date of permit authorization.

Historical Background

One of the Six Minimum Control Measures required in the USEPA Phase II stormwater rule is Illicit Discharge Detection and Elimination. The 2004 Tier A MS4 NJPDES permit implemented these regulations as an SBR named "Illicit Connection Elimination and MS4 Outfall Pipe Mapping." This permit condition required the Tier A Municipality to adopt an ordinance prohibiting illicit connections to the Tier A Municipality's small MS4, map the location of the end of small MS4 outfall pipes, train employees on illicit connections, outfall pipe mapping and outfall pipe stream scouring, and create and maintain a program to inspect outfall pipe maps.

MS4s are designed to convey stormwater only. Unlike discharges into sanitary sewers, discharges into MS4s receive no treatment before entering surface waters. EPA recognized that non-stormwater discharges to MS4s can be significant sources of pollutants to surface water bodies. These discharges can be the result of direct connections (physical connections to the MS4 pipes) or other means, such as overland flow that eventually reaches a storm drain. Illicit discharges can result from either outside sources (private entities or other MS4s) or from the municipality itself (floor drains, vehicle or equipment washwater). Examples of other illicit discharges include washwater from commercial car washes or illegal dumping of oil into storm drain inlets.

When the Department issued the Tier A MS4 NJPDES permit in 2004, it addressed EPA's concerns by requiring municipalities to:

- adopt an ordinance prohibiting non-stormwater discharges into the MS4;
- train their employees on illicit discharges, outfall pipe mapping and outfall pipe stream scouring; and
- create and maintain a program to inspect outfall pipes for illicit discharges and outfall pipe stream scouring.

These requirements were carried forward through the 2009 and 2018 renewals of the Tier A MS4 NJPDES permit. The 2018 Tier A MS4 NJPDES permit renewal also requires the municipality to inspect each of the outfall pipes owned or operated by the municipality. Inspections of each outfall pipe must be completed every five years, evaluating each outfall for illicit discharges and for outfall pipe stream scouring. Adequate documentation of each inspection should be completed, as further indicated below. The 2018 renewal also requires that the municipality keep the outfall pipe map up-to-date and that the map be electronically transmitted to the Department by December 21, 2020.

Introduction

MS4s are designed to convey stormwater from streets, roofs, parking lots and other surfaces directly to surface water bodies. Because stormwater discharges usually don't receive any treatment, it is very important that other pollutant sources do not discharge into the MS4. The Tier A MS4 NJPDES permit authorizes stormwater discharges from small MS4s owned or operated by Tier A Municipalities, municipal maintenance yards and other ancillary operations and specific non-stormwater discharges. The complete list of eligible non-stormwater discharges includes:

- Potable water line flushing and discharges from potable water sources, excluding the discharge of filter backwash and first flush water from potable well development/redevelopment activities utilizing chemicals in accordance with N.J.A.C. 7:9D. The volume of first flush water, which is a minimum of three times the volume of the well water column, must be handled and disposed of properly;
- Uncontaminated ground water (e.g., infiltration, crawl space or basement sump pumps, foundation or footing drains, rising ground waters);
- Air conditioning condensate (excluding contact and non-contact cooling water and industrial refrigerant condensate);
- Irrigation water (including landscape and lawn watering runoff);
- Flows from springs, riparian habitats, wetlands, water reservoir discharges and diverted stream flows;
- Residential car washing water and dechlorinated swimming pool discharges from single family residential homes;
- Sidewalk, driveway and street wash water;
- Flows from firefighting activities including the washing of fire fighting vehicles;

- Flows from clean water rinsing of beach maintenance equipment immediately following use and only if the equipment is used for its intended purpose;
- Flows from clean water rinsing of equipment and vehicles used in the application of salt and de-icing materials. Prior to rinsing, all equipment shall be cleaned using dry methods such as shoveling and sweeping. Recovered materials are to be returned to storage or properly discarded; and
- Rinsing of equipment above is limited to exterior, undercarriage and exposed parts and does not apply to engines or other enclosed machinery.

All discharges that do not fall under one of the categories described above are considered illicit discharges. Examples of illicit discharges include sanitary sewer connections to the MS4, or improper disposal of waste, such as discharges of non-contact cooling water. Illicit discharges to MS4s can result in the discharge of significant pollutant loads to surface water bodies. Therefore, the Tier A Municipality is required to develop, update, implement and enforce an ongoing Illicit Discharge Detection and Elimination Program. As part of this SBR, the Tier A Municipality is required to develop, update and maintain an outfall pipe map showing the location of the end of all MS4 outfall pipes owned or operated by the Tier A Municipality. In addition, the Tier A Municipality must develop, update and implement a program to detect, investigate and control any localized stream scouring from outfall pipes owned or operated by the municipality. Stream scouring results in increased sediment loading to water bodies and can reduce stream bank and outfall pipe stability and contribute to the degradation of water quality.

MS4 Outfall Pipe Mapping

The first step in developing effective stream scouring and Illicit Discharge Detection and Elimination programs is to develop an outfall pipe map showing the location of the end of all MS4 outfall pipes owned or operated by the Tier A municipality that discharge to surface water. The map must also show the location of all surface water bodies receiving discharges from those outfall pipes. The map must be kept up to date and any newly constructed, or newly discovered, outfall pipes must be added to the map as the Tier A Municipality becomes aware of their existence. The map can be maintained in hardcopy or GIS form; however, in accordance with federal rules, the Tier A Municipality is required to submit the maps to the Department electronically by December 21, 2020.

To assist the Tier A Municipality with the required collection of location information of MS4 Outfall Pipes and other inspected facilities, the Department has developed a voluntary, free to use application, or "app." This application allows a permittee to inventory and map stormwater facilities at its convenience, with the data automatically uploaded to the Department's servers. After review, the data will be made available for both NJDEP and public viewing. A permittee will need to possess an ArcGIS Online license to access this application. A permittee who currently possesses an ArcGIS Desktop License will have an ArcGIS Online license as part of that software package. For those without a license, the Department will be providing ArcGIS Online seats (licenses) at no cost to permittees to help offset the cost of utilizing modern methods of collecting location information if a municipality chooses to use such methods. Additionally, the Department will be conducting free regional training sessions centered on how to use the provided mapping and inventory tools. The Department is also willing to conduct one on one training sessions with permittees, if requested.

The Department anticipates that the app will be expanded in future versions to allow the user to

document additional information, including records of maintenance actions. When the expanded app is available, a permittee may be able to use the app to demonstrate compliance with the maintenance requirement in the Tier A MS4 NJPDES permit.

For more information on mapping, see http://www.nj.gov/dep/dwq/msrp_map_aid.htm and *Chapter 6: Optional Measures*.

Outfall Pipe Stream Scouring Detection and Control

Outfall pipe stream scouring is the localized scouring of the stream bank or bottom caused by the discharge from the outfall pipe. This type of erosion to the stream bed and stream banks can cause sedimentation in waterbodies. While sedimentation is a natural process, the accelerated accumulation of sediments in aquatic ecosystems leads to a decline in surface water quality and biodiversity.

Scouring occurs when the velocity of stormwater leaving an outfall pipe erodes the stream bottom or the stream bank. To prevent scouring from occurring, the exit velocity of the water from the outfall pipes must be dissipated and/or reduced. Stream bank stabilization is needed when vegetative stabilization practices are not practical and where the stream banks are subject to heavy erosion. One way to prevent scouring from occurring is to install or retrofit stormwater management facilities to reduce the flow rate leaving the outfall.

Another solution to stream and stream bank scouring is to implement one or more of the engineering standards approved by the State Soil Conservation Committee. The New Jersey Department of Agriculture's *Standards for Soil Erosion and Sediment and Control in New Jersey* are available at http://www.nj.gov/agriculture/divisions/anr/nrc/njerosion.html. The Tier A Municipality can also contact the local Soil Conservation District for further guidance. See http://www.nj.gov/agriculture/divisions/anr/pdf/soilconservationdistricts2017.pdf for a listing of the Districts.

The Tier A Municipality must develop, update and implement a program, to detect, investigate and control any localized stream scouring from stormwater outfall pipes owned or operated by the municipality. This program must identify all areas where localized stream and bank scouring occurs as a result of stormwater discharges from a municipality's MS4 system. The program does not apply to outfall pipes that discharge into the ocean or any other waterways that are not streams. For purposes of this permit, a stream may be perennial or intermittent, may be tidal or non-tidal and may be named or unnamed. Any areas that are found to have scouring must be prioritized based on the severity of the erosion and any approved or adopted TMDLS. For more information on TMDLs, see *Chapter 4.2: TMDLs.* Repairs of scouring must be scheduled and completed. All stream scouring restoration must be conducted in accordance with the *Standards for Soil Erosion and Sediment Control in New Jersey* (N.J.A.C. 2:90-1) and the requirements for bank stabilization and channel restoration found in the Flood Hazard Area Control Act Rules at N.J.A.C. 7:13-12.14 All associated maintenance or repairs for stormwater facilities must be made in accordance with the design performance standards and maintenance requirements set forth in the New Jersey Stormwater Best Management Practices Manual, which is located at http://www.njstormwater.org/bmp_manual2.htm.

The Tier A Municipality must consider any required permits and issues related to accessing areas with stream scouring when prioritizing and scheduling repairs. Prior to conducting any repairs or remediation, the municipality should communicate with the Department's Division of Land Use Regulation (www.nj.gov/dep/landuse), who may require permits under The Freshwater Wetlands Protection Act Rules, The Flood Hazard Area Control Act Rules, The Coastal Zone Management Rules, and/or The Highlands Water Protection and Planning Rules.

Illicit Discharge Detection and Elimination

The Tier A Municipality is required by the Tier A MS4 NJPDES permit to adopt and enforce an ordinance to prohibit illicit connections to the MS4. In addition, the Tier A Municipality is required to develop, update, implement and enforce an ongoing Illicit Discharge Detection and Elimination Program. As part of this program, the Tier A Municipality is required to, at a minimum, do the following:

- conduct visual dry weather inspection of all outfall pipes owned or operated by the municipality at least once every five years;
- investigate the source if evidence of illicit discharge is found;
- eliminate non-stormwater discharges that are traced to their source and found to result from illicit connections;
- document investigations and actions taken;
- inspect any newly identified outfall pipes for illicit discharges;
- investigate dry weather flows discovered during routine inspection and maintenance; and
- investigate all complaints and reports of illicit discharges within three months of receipt.

Because MS4s are specifically designed to carry stormwater, the outfall pipes generally should not be discharging during substantial dry periods. Flow that occurs 72 hours or more after a rain event is referred to as dry weather flow. Dry weather flow can originate from various non-stormwater sources, including those eligible non-stormwater discharges discussed above. However, dry weather flow can also be an indication of an illicit discharge. Therefore, the first step in inspecting an outfall pipe for an illicit discharge is to look for dry weather flow. Some illicit discharges, such as those from a connected sanitary sewer, can cause continuous dry weather flow. Others, such as discharges of cooling water from industrial sites, can be intermittent. Therefore, it is important that the Tier A Municipality regularly inspect the outfalls for dry weather flow. Other potential indicators of dry weather flow include staining of the outfall pipes, odors or deterioration of the outfall structure. If these or other indicators of illicit discharges are found, follow up investigations are required to identify whether or not they are being caused by an illicit discharge. If the Tier A Municipality finds dry weather flows, they should collect information that will allow them to identify the source of the flow. Specifically, the Tier A MS4 NJPDES permit requires the Tier A Municipality to complete the Department's Illicit Discharge Inspection Report Form, which can be found online at http://www.nj.gov/dep/dwq/tier_a_forms.htm, to document investigations and actions taken. This form is a useful tool and contains all of the information that the Tier A Municipality must collect when there is evidence of dry weather flows or illicit discharges. The information to be collected includes an estimate of the discharge flow rate, for which there are various methods of estimation, including timing

(i.e., how long it takes to fill a container of a known size), odor, color, turbidity, floatable matter, temperature, deposits and stains, vegetation and algal growth and condition of the outfall structure. Information compiled from physical observations and field monitoring are to be used to help identify potential sources. These observations are very important since they are the simplest method of identifying potential sources of dry weather flows.

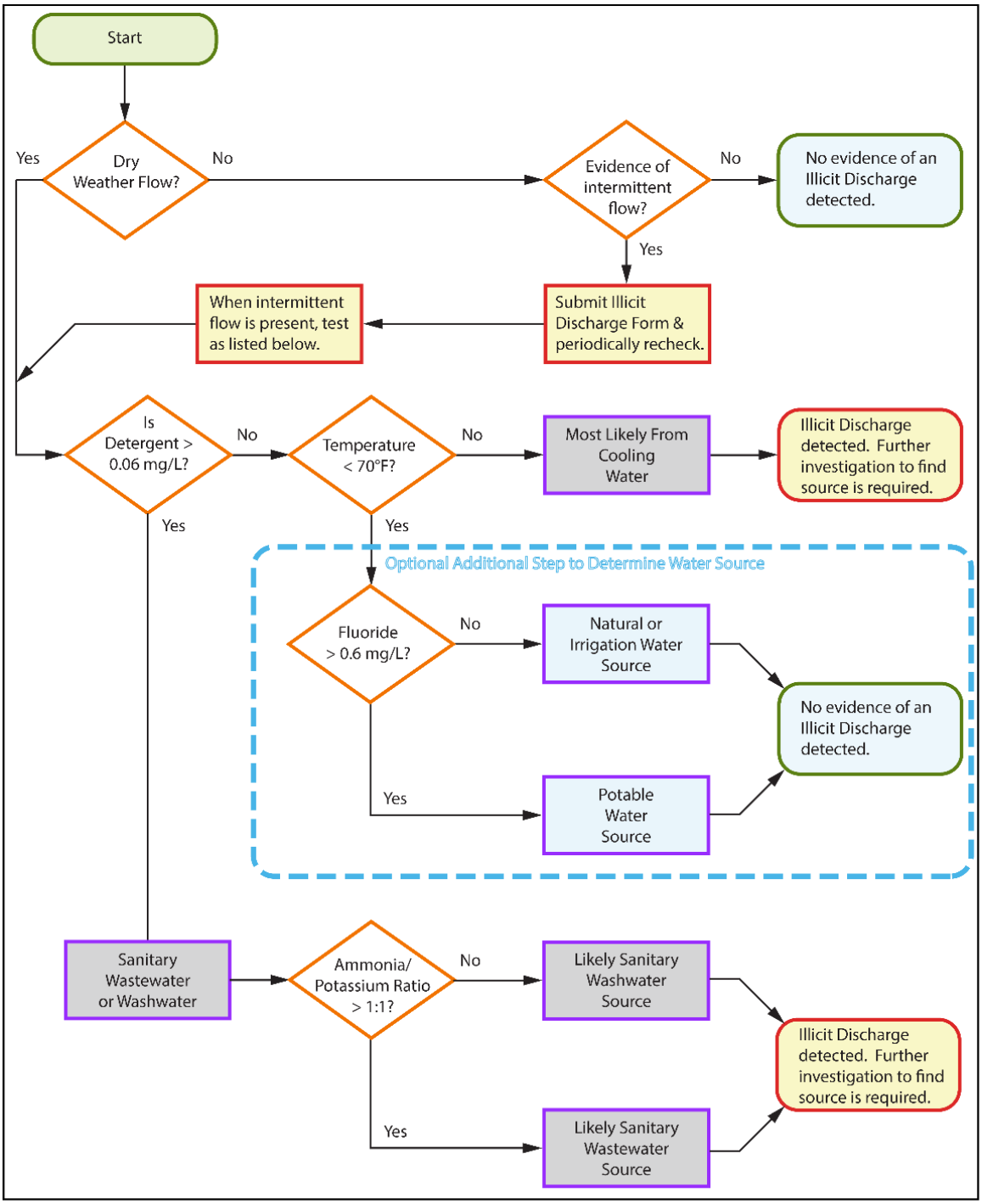
If a dry weather flow exists, after making all physical observations, the flow must be tested for detergents, i.e., surfactants, such as methylene blue active substances (MBAS). Monitoring for detergents, using a testing procedure with a detection limit of 0.06 mg/L, can accurately distinguish between discharges that are contaminated by sanitary wastewater and those that are not. Dry weather flows that contain detergents in excess of the detection limit require further investigation and are to be given the highest priority. Dry weather flows that do not test positive for detergents and do not show physical characteristics of sanitary wastewater (e.g., odor, floatables, and/or color) are unlikely to be from sanitary wastewater sources, yet they may still be illicit discharges of industrial wastewater, rinse water, backwash or cooling water.

Non-stormwater discharges that are detergent-free, and therefore not sanitary, should be tested for fluoride. Fluoride concentration is a reliable indicator of whether the non-stormwater flow is from a potable or non-potable water source. Fluoride concentrations greater than 0.6 mg/L indicate that potable water is the most likely source. Non-stormwater discharges that test below the detection limit for fluoride are likely to be groundwater infiltration, springs or streams. In some instances, a Tier A Municipality may find a non-stormwater discharge that originates from an on-site well used for industrial cooling water which will test non-detect for both detergents and fluoride. The Tier A Municipality will have to rely on temperature to differentiate between these cooling water discharges and ground water infiltration and other natural flows. Fluoride testing won't be able to pinpoint the source of the illicit discharge but is a helpful tool in further narrowing the search.

The ratio of ammonia (as N) to potassium can be used to help distinguish a sanitary wastewater source from a washwater source. Detergents will be present in both sanitary sewage and washwater. Generally, the ammonia/potassium ratio of sanitary sewage will be greater than 1.0. Non-stormwater flows with an ammonia/potassium ratio less than 1.0 are likely to be a washwater source.

All of the tests recommended for the tracing of illicit discharges may be performed in the field by employees of the Tier A Municipality or may be contracted out. Lab certification for those parameters is not required. It is advised that the person taking the field sample be familiar and trained in appropriate field testing protocol and be familiar with the equipment to be used. Analysis for detergents (MBAS), fluoride, ammonia and potassium may be conducted by using a field spectrophotometer produced by various lab instrument manufacturers. The spectrophotometers are accurate, easy to use with limited training and are designed to be used in the field. The flow chart on the following page illustrates the recommended steps to use when identifying an illicit discharge.

Illicit Discharge Identification Flow Chart



Investigation

Any storm sewer outfall pipe found during the initial inspection, or on any subsequent inspection, to have a non-stormwater discharge, or indications of an intermittent non-stormwater discharge, requires further investigation by the Tier A Municipality to identify and locate the specific source. Non-stormwater discharges suspected of being sanitary sewage and/or significantly contaminated must be prioritized and investigated first. Dry weather flows believed to be an immediate threat to human health or the environment must be reported immediately to the NJDEP Hotline at 1-877-WARNDEP (1-877-927-6337). Investigations of non-stormwater discharges suspected of being cooling water, washwater or natural flows may be delayed until after all suspected sanitary sewage and/or significantly contaminated discharges have been investigated, eliminated and/or resolved.

The use of field testing further narrows the potential sources of the non-stormwater discharge. However, it is unlikely that either the physical observations or the field testing alone will pinpoint the exact source of the dry weather discharge. As a result, the Tier A Municipality will need to perform upstream investigations to identify potential illicit discharges. Common approaches to identifying potential sources of illicit discharges include drainage system surveys (field testing at upstream manholes, visual inspections, video/televised, smoke and dye testing) and industrial and commercial site assessments.

A drainage system survey may require the Tier A Municipality to inspect storm sewer lines that lead to the outfall pipe where evidence of an illicit discharge was found. Physical observations and additional field testing will help the Tier A Municipality locate the dry weather flow while tracing the source of the discharge. Depending on the size and complexity of the storm drain system, it may be possible to isolate smaller portions of the system for more intensive investigations including smoke tests, dye testing and televised inspections.

The Tier A Municipality may be able to work with industrial or commercial facilities to try to locate the source of the illicit discharge. The Tier A Municipality can perform inspections of industrial or commercial sites or request the owners or operators of the sites to perform inspections of likely sources of illicit discharges, such as floor drains, wash bays and cooling water systems. NJDEP Compliance and Enforcement can also aid the municipality in performing inspections when the suspected source of an illicit discharge is a site covered under a NJPDES permit. To help narrow the list of potential sources, the Tier A Municipality can distribute questionnaires or use another method to collect information. Facilities may not be aware that these connections are illicit discharges and may be able to find and eliminate the sources on their own. However, it is important to note that illicit discharges may also sometimes originate from residential properties or other interconnected MS4 systems.

Elimination

Non-stormwater discharges traced to their source and found to be the Tier A Municipality's own illicit discharges must be eliminated. The Tier A Municipality may apply for a NJPDES permit for the discharge, but the discharge must be ceased until a valid NJPDES permit has been issued by the Department. Otherwise, the Tier A Municipality is required to verify that the illicit discharge was eliminated and ensure that measures taken to cease the discharge are permanent and are not done in such a manner that would allow easy reconnection to the MS4.

If the source of an illicit discharge cannot be located or is found to emanate from an entity other than the Tier A Municipality, then the Tier A Municipality must submit to the Department a written explanation detailing the results of the investigation. If the illicit discharge is found to be from another public entity, the Tier A Municipality must also notify that entity.

Below and on the following page is a guide for use in identifying illicit connections.

MS4 Outfall Pipe Mapping and Illicit Discharge Guide	
Characteristic	**Indicators**
Odor	*Sewage:* smell associated with stale/septic sanitary wastewater *Sulfur ("rotten eggs"):* industries that discharge sulfide compounds or organics (meat packers, canneries, dairies, etc.) *Oil and gas:* petroleum refineries or many facilities associated with vehicle maintenance or petroleum product storage *Rancid-sour:* food preparation facilities (restaurants, hotels, etc.)
Color	Important indicator of inappropriate industrial sources. Industrial dry weather discharges may be of any color, but dark colors, such as brown, gray, or black, are most common. *Yellow:* chemical plants, textile and tanning plants *Brown:* meat packers, printing plants, metal works, stone and concrete, fertilizers, and petroleum refining facilities *Red:* meat packers *Gray:* dairies, sewage
Turbidity	Often affected by the degree of gross contamination. Dry weather industrial flows with moderate turbidity can be cloudy, while highly turbid flows can be opaque. High turbidity is often a characteristic of undiluted dry weather industrial discharges. Cloudy: sanitary wastewater, concrete or stone operations, fertilizer facilities, and automotive dealers Opaque: food processors, lumber mills, metal operations, pigment plants
Floatable Matter	A contaminated flow may contain floating solids or liquids directly related to industrial or sanitary wastewater pollution. Floatables of industrial origin may include animal fats, spoiled foods, solvents, sawdust, foams, packing materials, or fuel. Floatables in sanitary wastewater include fecal matter, toilet paper, sanitary napkins and condoms.

MS4 Outfall Pipe Mapping and Illicit Connection Guide (*cont'd.*)	
Characteristic	**Indicators**
Deposits and Stains	Deposits and stains on outfall structures may be evidence of intermittent non-stormwater discharges. Deposits and stains include coatings, residues or fragments of materials. Grayish- black deposits that contain animal flesh or hair may be from leather tanneries. White crystalline powder is usually due to nitrogenous fertilizer wastes. Excessive sediment deposits may be attributed to construction site erosion. Sources of oily residues may include petroleum refineries, storage facilities, and/or vehicle service facilities.
Vegetation	Vegetation surrounding an outfall may show the effects of industrial pollutants. Decaying organic materials coming from food processors may cause increased vegetation growth. Other toxic materials from industrial discharges may decrease or kill vegetation. Non-stormwater discharges that contain excessive nutrients from concentrated animal feeding activities may also kill vegetation.
Damage to Outfall Structures	Cracking, deterioration, and scouring of concrete or peeling of paint at an outfall pipe may be caused by severely contaminated industrial discharges that are extremely acid or basic. Primary metal industries may discharge highly acidic batch dumps. Food processors with discharges that become "septic" produce hydrogen sulfide gas, which quickly deteriorates metal surfaces.
Temperature	Both sanitary wastewater and cooling water may substantially increase the outfall discharge temperature. Elevated temperature measurements in discharges that test negative for detergents are likely to be cooling water discharges. Sources of cooling water discharges would be industrial facilities in the drainage area.

Recommendations

The following recommendations may be beneficial, but are not required by the permit:

- To help reduce costs, look for signs of illicit discharges and outfall pipe stream scouring every time the municipality maps or inspects outfalls. This will reduce the need for multiple visits to the same outfall pipes;
- Map your entire MS4 system in addition to the required maps. An accurate map of the entire storm sewer system will aid in the investigation and elimination of illicit discharges and allow for better stormwater facilities management and better planning of new development. Consider a coordinated effort with any local watershed association, environmental group, or civic group that may assist with mapping using the NJDEP's mapping app;
- If the entire storm sewer system is mapped, indicate on the map primary uses and development in areas within the system (e.g., residential, industrial, commercial, farm/agriculture);
- Use the most accurate methods feasible for locating the end of the outfall pipe, such as GPS technology;
- In tidal areas, mapping field work should coincide with low tide to help ensure that outfall pipes are visible;
- Aerial, infrared and thermal photography may be helpful in identifying suspect discharges;
- Support and sponsor stream or shoreline walks by environmental groups, watershed associations and civic groups to assist in identifying suspect discharges; and/or
- Conduct routine dye testing of industries and commercial establishments that have a greater probability of illicit connections (automobile-related businesses, restaurants).