ILLICIT DISCHARGE DETECTION AND ELIMINATION (IDDE) PROGRAM MANUAL

City Policies and Procedures

V.2.0

City of Lexington Public Works

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Illicit Discharge Detection and Elimination Program Manual

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Section 1 – Introduction

1.1 Background

The City of Lexington, Nebraska has made a commitment to protect and manage Nebraska's natural resources. Within the Public Works Department, the Stormwater Management program seeks to minimize the negative effects of development and pollution, while maximizing environmental protection and conservation. Protecting and preserving the quality of the City's surface water is a key focus area of the program.

According to the US EPA's 2000 National Water Quality Inventory, 39 percent of assessed river and stream miles, 46 percent of assessed lake acres, and 51 percent of assessed estuarine square miles do not meet water quality standards. The top causes of impairment include siltation, nutrients, bacteria, metals (primarily mercury), and oxygen-depleting substances. Polluted stormwater runoff, including runoff from urban/suburban areas and construction sites is a leading source of this impairment. To address this problem, EPA established the National Pollutant Discharge Elimination System (NPDES) program as part of the Clean Water Act to regulate stormwater discharges.

In the State of Nebraska, EPA has delegated the NPDES program administration to the Department of Environmental Quality (NDEE). NDEE issued a Small Municipal Stormwater (sMS4) Permit to the Lexington in 2005, with subsequent permit issuances in 2011 and 2018. The sMS4 Permit requires the City to have a stormwater management plan (SWMP) with five major conditions. One of those conditions requires "The SWMP shall include an ongoing program to detect and remove illicit connections, discharges as defined in 40 CFR 122.26(b)(2), and improper disposal, including any spills…, into the municipal separate storm sewers owned or operated by the Permittee." The overreaching program goal is to prevent, locate, and correct illicit discharges.

The City's IDDE program is managed by the City's Public Works and Fire Departments. Maintenance staff and construction site inspectors also play an important role identifying illicit discharge problems and responding to clean-up requests. However, all Public Works, Planning and Community Development, Parks, Police, and Fire staff will play a role in locating, identifying, and reporting potential illicit discharges.

1.2 Summary of the IDDE Program

The sMS4 Permit requires the permittees to develop an IDDE program encompassing the elements listed below. Each element is addressed in the sections of this IDDE Program Manual as noted below.

- Adopt an ordinance to prohibit non-stormwater, illegal discharges, and/or dumping into the storm sewer system (Section 2);
- Develop a municipal storm sewer system map (Section 3);
- Implement an on-going program to detect and address non-stormwater discharges, spills, illicit connections, and illegal dumping (Section 4, 5, 6);
- Educate employees, businesses, and the general public about illicit discharge concerns (Section 7);
- Adopt and implement procedures for program evaluation and assessment (Section 8);
- Maintain records of all IDDE program activities (Section 8); and
- Provide IDDE training for municipal staff (Section 9).

This manual is intended to assist City staff in implementing the IDDE program. It is to be used as a guidance document for staff in their day-to-day activities related to IDDE. This document can also be used as a training tool to ensure that staff is following the same procedures in responding to illicit discharge concerns.

Section 2 – Prohibiting Illicit Discharges

2.1 What is an Illicit Discharge?

An illicit discharge is defined by EPA as "…any direct or indirect non-stormwater discharge to the city's storm drain system, except as expressly allowed by this chapter." In most communities, the MS4 is directly connected to a waterbody and does not receive any type of treatment prior to its discharge to receiving water bodies of the United States. Because there is little or no treatment, it is vital that only stormwater be discharged from these MS4s. The general permit received by Phase II regulated communities requires that those communities develop an IDDE program. This program will assist communities in meeting their requirement set forth in their General NPDES Stormwater permit.

Examples of illicit discharges include (but are not limited to) the following:

- Disposal of vehicle maintenance fluids into a storm drain;
- Hosing or washing loading areas in the vicinity of storm drain inlets;
- Leaking dumpsters flowing into a storm drain inlet;
- Old and damaged sanitary sewer line leaking fluids into a cracked or damaged storm sewer line.
- Pouring paints or stains into a storm drain;
- Allowing wash water with soaps or detergents into a storm drain inlet;
- Washing silt, sediment, concrete, cement or gravel into a storm drain; and
- A measurable flow during dry weather that contains pollutants or pathogens.

2.2 Types of Illicit Discharges

Illicit discharges can be separated into three (3) categories based on frequency of discharge:

1. **Transitory Illicit Discharge:** These are typically a one-time event. They can result from spills, dumping, and line breaks and are often the most difficult to investigate and trace back to its source.
2. **Intermittent Illicit Discharge:** These are typically discharges that occur occasionally. They can occur several hours per day, week or over the course of a year and can happen as the result of line breaks or cross connections.
3. **Continuous Illicit Discharge:** These direct connections into the MS4 can be from sanitary sewers, cross connections, infrastructure problems with a sanitary sewer system, or malfunctioning household sewage treatment systems (HSTS).

Of these three types, the Continuous Illicit Discharge is the easiest to find, investigate, trace and eliminate from the MS4. This type of discharge also has the greatest impact because of the constant pollutant loading into a water body.

Table 2-1 Transitory or Intermittent Illicit Discharges

Land Use	Likely Source Locations	Condition/Activity that Produces Discharge
Residential	· Apartments · Multi-Family · Single Family Detached	· Car Washing · Driveway Cleaning · Dumping/Spills · Equipment Wash-Downs · Lawn/Landscape Watering · Septic System Maintenance · Swimming Pool Discharges · Laundry Wastewater · Improper Plumbing (e.g. garage floor drains)
Commercial	· Campgrounds/RV Parks · Car Dealers/Rental Car Comp. · Car Washes · Laundry or Dry Cleaners · Gas Stations/Auto Repair Shops · Nurseries and Garden Centers · Oil Change Shops · Restaurants · Swimming Pools · Service Garages	· Dumping/Spills · Landscaping/Grounds Care (e.g. irrigation) · Outdoor Fluid Storage · Parking Lot Maintenance (e.g. power washing) · Vehicle Fueling · Vehicle Maintenance/Repair · Vehicle Washing · Wash-down of Greasy Equipment & Grease Traps
Industrial	· Auto Recyclers · Beverages and Brewing · Construction Vehicle Washouts · Distribution Centers · Food Processing · Garbage Truck Washouts · Metal Plating Operations · Paper and Wood Products · Petroleum Storage and Refining · Printing	· All Commercial Activities · Industrial Process Water or Rinse Water · Loading and Un-loading Area Wash-downs · Outdoor Material Storage (e.g. fluids)
Municipal	· Airports · Landfills · Maintenance Depots · Municipal Fleet Storage Areas · Public Works Yards · Streets and Highways	· Building Maintenance (e.g. power washing) · Dumping/Spills · Landscaping/Grounds Care (e.g. irrigation) · Outdoor Fluid Storage · Parking Lot Maintenance (e.g. power washing) · Road Maintenance · Emergency Response · Vehicle Fueling · Vehicle Maintenance/Repair · Vehicle Washing

Source: Modified from *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments*, Center for Watershed Protection, 2004, p. 12, Table 2.

Table 2-2 Continuous Illicit Discharges

Land Use	Condition or Activity that Produces Discharge
Residential	· Failed sanitary sewer infiltrating into stormwater system · Sanitary sewer connection into stormwater system · Failed septic systems discharging to stormwater system
Commercial/Industrial	· Failed sanitary sewer infiltrating into stormwater system · Process water connections into stormwater system · Sanitary sewer connection into stormwater system
Municipal	· Failed sanitary sewer infiltrating into stormwater system · Sanitary sewer connection into stormwater system

Source: *Guidelines and Standard Operating Procedures for Stormwater Phase II Communities in Maine*, Casco Bay Estuary Partnership.

Tables 1-1 and 1-2 examine the likely source locations that contribute illicit discharges to a MS4. Land use can predict the potential for these discharges. By understanding the possible discharges originating from land use activities, it allows for the IDDE inspector to thoroughly utilize this knowledge in identifying illicit discharges and their potential sources. Industrial facilities are regulated by additional permits through NDEE. For industrial questions please contact NDEE at (402) 471-2186 or visit their website at www.deq.state.ne.us.

2.3 Mode of Entry

Illicit discharges can also be classified based on how they enter the stormwater system. This entry can be direct or indirect.

1. **Direct entry:** The discharge is directly connected to the stormwater system via a pipe. This type of entry will produce discharges that are either continuous or intermittent. Direct entry usually occurs when there are sewage cross-connections, or where there are industrial and commercial cross-connections.
2. **Indirect entry:** Flows, which are generated outside the stormwater system, enter through stormwater inlets or by infiltrating through the joints of the pipe. Generally, indirect modes of entry produce intermittent or transitory discharges. This type of entry can include groundwater seepage into the stormwater pipe, spills, dumping, outdoor washing activities, and irrigation from landscaping or lawns that reaches the stormwater system.

2.4 Allowable Non-Stormwater Discharges

The IDDE program does not need to address all illicit discharges unless you identify them as significant contributors of pollutants to your small MS4. Under the NDEE sMS4 Permit rules, examples of this include:

- Water line flushing
- Landscape irrigation
- Diverted stream flows
- Rising groundwater
- Uncontaminated groundwater infiltration
- Uncontaminated pumped groundwater
- Discharges from potable water sources
- Foundation drains

- Air conditioning condensation
- Irrigation water
- Springs
- Water from crawl space pumps
- Footing drains
- Lawn watering
- Individual residential car washing
- Flows from riparian habitats and wetlands
- Dechlorinated swimming pool discharges
- Street wash water
  (discharges from emergency firefighting activities are excluded from the effective prohibition against non-stormwater and need only be addressed where they are identified as significant sources of pollutants to waters of the State of Nebraska)

2.5 City IDDE Ordinance

In February 2011, the City adopted City Code Chapter 12, Article II – Stormwater Management. A copy of the full ordinance and code chapter, including definitions and a listing of discharges specifically or conditionally allowed, is included in **Appendix A**.

Section 3 – Storm Sewer System Mapping

3.1 Overview

The first major component of the City's illicit discharge program is the mapping of the municipal stormwater drainage system. Maintaining an accurate map of the stormwater drainage system will make it easier for the City to track and locate the source of suspected illicit discharges. The sMS4 Permit outlines minimum information that should be included in the City's municipal storm sewer system map:

- Location of all outfalls and the names and location of all waters of the state that receive discharges from those outfalls,
- If the sMS4 system connects to another MS4 system, the outfall drainage areas can be limited to those that drain only to the permittee's system. Connections and interactions to other MS4 systems need to be delineated.

3.2 Inventory

City staff has located drainage features and recorded the locations and feature attributes using GIS mapping. City staff updates the system map with each new development that is completed within the MS4.

The City of Lexington will be responsible for updating the master NPDES outfall map to reflect any changes that have been agreed on. The City will update outfall attributes information for each location using the Outfall Reconnaissance Inventory (ORI) field sheet (**Appendix C**) for any new field screenings conducted. The City will remove all outfalls that are verified as non-existent, as well as add any outfalls not currently represented in the database. The data features to be collected and consolidated include catch basins, junction boxes, manholes, storm pipes, outfalls, flumes, driveway pipes, culverts, ponds, etc. For each feature, specific information will be gathered including size, material, type, length, comments, reference number, condition, ownership, etc.

The current outfall inventory map is included as **Appendix G**.

Section 4 – Illicit Discharge Detection Procedures

4.1 Purpose

Illicit discharges and connections are identified through citizen reporting, interdepartmental or interagency referral, or other routine MS4 inspection activities. The City relies on local citizens, field staff, and inspections to detect potential problem areas quickly, so that they can be addressed before they cause significant water quality degradation.

For any water quality incidents or spills, the general public is directed to call the City's main phone number (402-324-3811) to report concerns. The City encourages residents to participate in the reporting process and helps the City to receive timely information about problems like illegal dumping, spills, or strong odors. The City's related MS4 maintenance activities provide opportunities to document and identify potential problems that may not be obvious to the general public.

4.2 Incident Reporting

Via phone: 308-324-3811, ext. 112

Via email: bbrecks@cityoflex.com

Via website: www.cityoflex.com

The City will report immediately the occurrence of any dry weather flows believed to be an immediate threat to human health or the environment to NDEE by calling (402) 471-2186 or (402) 471-4545 after business hours, weekends, and holidays.

4.2.1 Contact Information

During normal business hours (Monday thru Friday 8:00am to 5:00pm) citizens, other City departments or outside agencies reporting incidents that have occurred within the city limits can call the City's Development Services Director at 308-324-3811.

After hours, emergency water quality incidents should be reported through the police department. Residents that encounter a non-emergency incident are encouraged to report the problem the next business day.

(If after hours messages are left on the City's Development Services voicemail, staff follow-up with the caller during the next business day.)

4.2.2 Problem Documentation

When water quality incident reports are received, the staff person receiving the information should complete an Incident Report Form or other form and submit it to the appropriate personnel for follow up. Once recorded, incident information is referred to the appropriate City department and/or staff person for follow-up.

In most cases, IDDE problems should be referred to the Development Services Director for further investigation. Staff will either follow the investigation procedures in Section 5 to identify the source of the problem or, if the source is known, the corrective action procedures outlined in Section 6 will apply.

4.3 Outfall Inspection Procedures

The City will conduct an Outfall Reconnaissance Inventory (ORI) to visually inspect outfalls from the City's stormwater drainage system to identify areas of obvious pollution or non-stormwater discharges. Outfall inspections can locate potential problem areas without the need for in-depth laboratory analysis. Potential problem discharges can be identified by outfalls that are flowing during dry weather (potential illicit connection) or outfalls that have high turbidity, strong odors, or unusual colors. Standard Operating Procedures for outfall screening follow Chapter 11 of the Center for Watershed Protection's *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments* (**Appendix D**)

Nebraska Administrative Code Title 119, Chapter 1 defines an **Outfall** as a point source as defined in Title 119 at the point where a municipal separate storm sewer discharges to waters of the State and does not include open conveyances connecting two separate storm sewer systems, or pipes, tunnels, or other conveyances which connect segments of the same stream or other waters of the State and are used to convey waters of the State.

Title 119 also defines a **Major Outfall** as a municipal separate storm sewer outfall that discharges from a single pipe with an inside diameter of 36 inches or more or its equivalent (discharge from a single conveyance other than circular pipe which is associated with a drainage area more than 50 acres); or for lands zoned for industrial activity (based on comprehensive zoning plans or equivalent), an outfall that discharges from a single pipe with an inside diameter of 12 inches or more from its equivalent (discharge from other than a circular pipe associated with a drainage area of 2 acres or more).

If inspection staff encounters a transitory discharge, such as a liquid or oil spill, during inspection activities, the problem should be immediately referred to the appropriate agency or response contractor for clean-up. Staff should also complete an Inspection Form.

4.3.1 Prioritization Schedule

The City estimates that the storm drainage infrastructure includes 10 known outfalls that discharge to Spring Creek, Dawson Country Drain Number 1, and the Berquist Lateral. All major outfalls will be inspected annually. 33% of all minor outfalls will be inspected annually.

4.3.2 Responsibility

Inspections are the responsibility of the City Development Services Director, as directed. Inspections may be performed by City staff or by outside consultants hired by the City. In either case, all field reports will be reviewed the City's Development Services Director.

4.3.3 Timing

Timing is important when scheduling ORI field days. The preferred conditions for outfall inspections include:

- Dry season – preferably in summer or early fall
- No run-off producing rainfall within previous 48 hours
- Low vegetation (avoid late spring when access may be hindered by heavy vegetation)

The preferred conditions allow detection of flows when there should be none and prevent the dilution of pollutants.

4.3.4 Equipment

Prior to conducting field work, individuals should assemble all necessary equipment (see Table 4-1) and review records from prior inspections in the same area to become familiar with the outfall locations and any potential inspection challenges.

Table 4-1 Field Equipment for Outfall Inspections

Outfall Inspection Report Forms	Spray paint or other marker
Safety Gear – vest, hard hat, cones	Flash light or headlamp
Field Notebook/Pencils	Tool box
Cell phone w/ charged battery	First Aid Kit
Map or Aerial Photo of Inspection Area	Clear sample bottles
Digital camera w/ charged battery	Watch with second hand

After long periods of heavy rain, inspectors should allow 3-4 days of an antecedent dry period before starting or resuming inspections, so that rainfall runoff has a chance to clear the storm drainage system.

4.3.5 Activities

During ORI field days, inspectors should visually inspect each outfall and the immediate surrounding area, photograph the current conditions, and complete an Outfall Inspection Report form or other form.

Potential problems are indicated by outfalls that are flowing in dry weather and/or foul odors or discolored water in or around the outfall pipe. If an outfall with significant flow is encountered, inspectors should attempt to first determine the source of the flow. If groundwater has been ruled out as the source of the flow, then a flowing outfall may indicate a potential illicit discharge concern.

When illicit discharge problems are identified, inspectors will photograph the problem area and conduct a quick visual inspection of the surrounding area to identify any obvious pollution sources. For obvious illicit discharges, inspectors should consider collecting samples of the discharge, if possible, and begin filling out the Incident Report form to investigate the source of the pollutants as described in Section 5. These simple actions can give valuable direction to the upcoming IDDE inspection. Inspectors should file all outfall report forms, and update the record keeping database as appropriate. Additional record keeping information is included in Section 8.

During field inspections, inspectors should also note whether the outfalls have maintenance issues, such as trash around the outfall or damaged infrastructure that should be brought to the attention of the responsible department. Observed spills or environmental hazards should be immediately reported and documented using the proper forms.

4.3.5 Physical Indicators

During dry weather visual inspections, it is important to indicate the conditions observed at an outfall location. This includes: flow, odor, color, turbidity, etc. if present at the location. The information obtained from the physical characteristics observed are indicators and cannot be fully relied upon by themselves. Floatables are the best physical indicator. The most common floatables are sewage, suds, and oil sheens. The observation of sewage at an outfall location indicates that there is a severe problem with that MS4 and should be looked at as to where the source for the sewage is originating from. Suds can indicate a variety of things. Some suds are naturally formed by the movement of the water. If the suds are located at a water drop off and break up quickly, this may only be water turbulence related. If the suds have a fragrant odor, this can indicate the presence of laundry water or wash water in the waterbody. Oil sheens need to be looked at to try and determine the source of the oil sheen. Some oil

sheens are common and occur naturally by in-stream processes. This occurs when an iron bacteria forms a sheet-like film. This can be determined by looking at the sheen and seeing if it cracks when disturbed. Synthetic oil sheens, on the other hand, will swirl when disturbed. If this occurs, then the sheen is from an oil source.

When dry weather flows are observed at an outfall, the flow is considered non-stormwater related. This flow can be an illicit discharge, but it may also be a flow being generated from another action that is not considered illicit (See Chapter 1). Likewise, if no flow is observed at an outfall, it does not mean that there is no problem at that specific outfall. In Chapter 1, different types of illicit discharges including continuous, intermittent and transitory, were discussed. The continuous flows are the easiest to locate while the other two are not. That is why it is important to observe the area at each outfall's location for any type of observable pollution problem that may be the result of an intermittent or transitory illicit discharge.

It is extremely important for IDDE staff to recognize that during field inspections, the outfall is observed as a snapshot in time. To ensure that the City has an effective IDDE program, at a minimum, all major outfalls and 33% of the minor outfalls will be inspected on an annual basis, so that in five years the entire outfall inventory will be inspected.

4.4 Water Quality Sampling and Testing

When dry weather flows are observed, it will be difficult to determine if there is a problem with that flow. Obvious problems, such as strong sewage odor, or the presence of raw sewage or toilet paper, will indicate that there is a bacterial problem at that location coming from sanitary sewers, cross connections, or septic systems. However, in most circumstances, water that is observed during dry weather conditions will not have those visual indicators. That is why water quality testing and sampling is a vital component for an IDDE program.

Certain water quality parameters can serve as indicators of the likely presence or absence of a specific type of discharge. Some of these parameters can be measured in the field with specific instrumentation and field sample kits, while others will need to be analyzed at a laboratory. The City of Lexington uses the following parameters:

Table 4-2 Water Quality Test Parameters and Uses

Water Quality Test	Use of Water Quality Test	Comments/Suggested Ranges
Detergents (surfactants)	Indicate the presence of detergent (e.g., laundry, car washing)	Measured with detergent test / Less than 0.2 mg/l. If found to be significantly high, send sample to contract laboratory
Chlorine	Indicate evidence of draining of a swimming pool without proper dechlorination	DPD, Color Disc, 0-3.5 mg/L, Detection limit: 0.5 mg/L
Ammonia	Elevated levels are an indicator of sewage. High concentrations may also indicate liquid wastes from some industrial sites.	Test strip, 0-0.50 mg/L
Phenols	Indicate possible presence of improper sewer connection to a storm drain or ditch	Color Disc, 0-0.200 mg/L
pH	Extreme pH values (low or high) may indicate commercial or industrial flows; not useful in	Measured in the field and laboratory with a probe / pH is

	determining the presence of sanitary wastewater (which, like uncontaminated base flows, tends to have a neutral pH, i.e., close to 7)	(6-9) standard units (su)

4.5 Follow-up Actions

When potential problem areas are identified, inspectors should report the observations to the Development Services Director. A case log will be opened, and the investigation procedures outlined in Section 5 will be initiated. The Development Services Director will also determine if other City departments or outside agencies need to be involved.

Section 5 – Tracing the Source of an Illicit Discharge

5.1 Purpose

Potential illicit discharge problems can be revealed through outfall inspections or reports from staff, tenants, or the public as described in Section 4. The City of Lexington will initiate investigation and tracing of potential illicit discharges and/or contact the adjacent MS4 operator (NDOT) within two working days of notification or discovery. The follow-up investigation could include a site visit to look at the problem area, review of mapping information, review of past complaints or investigations at the location, or other data collection and review. Once a problem has been verified (either through a routine outfall inspection or follow-up to a called-in complaint) the City will begin an official illicit discharge investigation, following the procedures outlined in this section.

When an illegal dumping or illicit discharge problem is directly observed by a member of the City staff, it is generally not necessary to follow these investigation procedures. In those scenarios, the source of the problem discharge is already known. Problems revealed through direct observation are referred directly to the corrective action information in Section 6. If a reported problem does not have a defined source, the procedures in this section should be followed to trace the source of the illicit discharge.

5.2 Tracing Techniques

There are a number of different techniques that can be utilized to trace for an illicit discharge. When a dry weather flow or illicit discharge is documented, the City will initiate source tracing. Each technique listed must be fully understood and its limitations.

5.2.1 Visual Inspections of Stormwater Network

Once a dry weather flow is observed and it has been determined to be an illicit discharge, inspections along the specific MS4 conveyance system must occur. Typically, if the conveyance system is an open ditch, this is an easier process then if it is within an enclosed stormwater system. The inspection process utilizing this method needs to start at the initial detection location – the MS4 outfall where the illicit discharge has been observed and noted. The next step is to work "upstream" from this location – that is moving up the stormwater system to the first manhole. Check this manhole to see if there is evidence of flow. If flow is present, you may wish to sample the manhole; however, it is not required. If flow is observed at this manhole, move to the next upstream manhole. Keep moving upstream until no flow or low flow is observed. Keep in mind that as you move upstream, there may be junction lines entering the stormwater system at other locations. Utilize the stormwater maps to determine if this is the case. In these circumstances, you will need to check these manholes as well.

During this inspection process, key observations are necessary, including:

- Presence of flow
- Odors
- Colors/clarity
- Stains or deposits on the bottom of structure(s)
- Oil sheen, scum or foam on any standing water

During this process, sampling can be utilized to assist in this tracing process. Once areas are determined to have possible illicit source flows, sampling these individual locations and manholes can assist in directing where the source of the illicit discharge is located. Specific parameters can be used when looking for the illicit discharge. Refer to Chapter 3, Table 3-1 for sample parameters that can be used

for specific sources of illicit discharges. Typically, you will use the same parameter that was used when the initial sample was taken to determine if an illicit discharge was present at that flow.

5.2.2 Dye Testing

Once the area has been determined where the potential illicit discharge source is located, the utilization of dye testing will assist in determining the exact location of the illicit discharge. Permission is required on private property prior to starting a dye test procedure. If a dye test is needed on the inside of a building, written permission is required. Once permission is granted, the dye testing will begin. The dye needs to be put into the suspect location. This is done by pouring the dye into sinks, toilets, etc and then flushed through the sanitary sewer system. The stormwater and sanitary sewers need to be monitored to observe where the dye discharges to. This procedure is effective in determining direct connections of sanitary lines to storm lines.

5.2.3 Video Inspection

Another method in determining where the illicit discharge source is located, is televising the storm line. Video cameras can be used by either pushing or using a mobile video unit. Both cameras will provide detailed information as to where the infiltration or connection is located within the MS4 system.

5.2.4 Indicator Monitoring/Sampling

When dry weather flow is observed at an outfall location, and the sample reveals that there is a problem with this flow, further monitoring can be done to assist in the location of the illicit discharge. As manholes are opened and dry weather flow is observed, samples can be taken and analyzed. During this process, we are looking for a pattern within the sample analysis, depending on the parameter sampled for. During this type of tracing, monitoring will allow staff to determine if the dry weather flow observed is the source of the flow at the outfall location. There can be circumstances where dry weather flow occurs and it is not "illicit" due to its source (See Chapter 1). This flow can combine with an illicit source in the stormwater system making it difficult to trace. By monitoring the water observed, it will assist in the tracing of the illicit source discharging into the stormwater system.

Automatic Samplers can also be used during the investigation of intermittent flows. These samplers can be placed at specific locations within the stormwater system of a community. These samplers can be triggered by dry weather flows. This type of sampling and monitoring is not the best method for most communities due to the cost of the sampling equipment. This type of monitoring can be effective however, in areas with a large intermittent discharge problem and/or very complex stormwater system. These samplers will provide the date and time the sample was collected which will assist the community in locating the source of this discharge.

5.2.5 Smoke Testing

This method should be used during special circumstances when a good storm sewer map is not available for a location and there are known problems of connection issues. Smoke is introduced into the storm drainage system and will emerge at locations that are connected to that system. It is recommended that qualified personnel be used for this method to ensure accurate test results.

5.3 Follow-Up Actions

Once the source of an illicit discharge has been identified, the investigator should initiate private property site entry procedures (if needed), notify the property owner or operator of the problem, and provide the appropriate educational materials and/or a copy of the IDDE ordinance. This is an important first step in the corrective action process. The investigator completes the Incident Report Form or other form, and enters all information in the database case log to document the findings. The

Development Services Director can then begin working through the corrective action steps outlined in Section 6.

Section 6 – Elimination of an Illicit Discharge

Once an illicit discharge has been identified, staff must then determine who is responsible for the removal of the discharge. Example situations may include:

- Internal Plumbing Connection
- Service Lateral
- Infrastructure Failure
- Transitory Discharge

Once the removal of the illicit discharge has occurred, it must be confirmed to ensure the correction has been made.

There are various methods that can be used to remove an illicit discharge and to fix the problem, see table 6-1.

Table 6-1 Methods to Eliminate Discharges

Technique	Application	Description
Service Lateral Disconnection/Reconnection	Lateral is connected to the wrong line	Lateral is disconnected and reconnected to the appropriate line
Cleaning	Line is blocked or capacity is diminished	Flushing (sending a high pressure water jet through the line); pigging (dragging a large rubber plug through the lines); or rodding
Excavation and Replacement	Line is collapsed, severely blocked, significantly misaligned or undersized	Existing pipe is removed, new pipe placed in same alignment; Existing pipe abandoned in place, replaced by new pipe in parallel alignment
Manhole Repair	Decrease ponding; prevent flow of surface water into manhole; prevent groundwater infiltration	Raise frame and lid above grade; install lid inserts; grout, mortar or apply shot-crete inside the walls; install new precast manhole
Corrosion Control Coating	Improve resistance to corrosion	Spray- or brush-on coating applied to interior of pipe
Grouting	Seal leaking joints and small cracks	Seals leaking joints and small cracks
Pipe Bursting	Line is collapsed, severely blocked, or undersized	Existing pipe used as guide for inserting expansion head; expansion head increases area available for new pipe by pushing existing pipe out radially until it cracks; bursting device pulls new pipeline behind it
Slip Lining	Pipe has numerous cracks, leaking joints, but is continuous and mot misaligned	Pulling of a new pipe through the old one.

Table 6-1 (Continued) Methods to Eliminate Discharges

Fold and Formed Pipe	Pipe has numerous cracks, leaking joints	Similar to slip lining but is easier to install, uses existing manholes for insertion; a folded thermoplastic pipe is pulled into place and rounded to conform to internal diameter of existing pipe
Inversion Lining	Pipe has numerous cracks, leaking joints; can be used where there are misalignments	Similar to slip lining but is easier to install, uses existing manholes for insertion; a soft resin impregnated felt tube is inserted into the pipe, inverted by filling it with air or water at one end, and cured in place

Source: Modified from *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments*, Center for Watershed Protection, 2004

Section 7 – Corrective Action

7.1 Purpose

The City will respond to identified illicit discharges, illicit connections, or illegal dumping activities using progressive enforcement actions. Corrective actions will focus first on education to promote voluntary compliance and escalate to increasingly severe enforcement actions if voluntary compliance is not obtained.

7.2 Voluntary Compliance

The preferred approach to address illicit discharge problems is to pursue voluntary compliance through property owner or responsible party education. Often, business operators and property owners are not aware of the existence of illicit connections or activities on their properties that may constitute an illegal discharge. In these cases, providing the responsible party with information about the connection or operation, the environmental consequences, and suggestions on how to remedy the problem may be enough to secure voluntary compliance.

Education begins during the site investigation when the operation or connection is first confirmed. Property owners and operators should be notified that the problems must be corrected in a timely manner and that the City will be conducting a follow-up site visit to verify compliance. Field staff should also provide the property operator with an educational brochure describing illicit discharge violations and a copy of the applicable City code. Field staff should also remind property owners of their obligation to report discharges to the proper agencies.

As soon as any person responsible for a facility, activity or operation, or responsible for emergency response for a facility, activity or operation has information of any known or suspected release of pollutants or non-stormwater discharges from that facility or operation resulting in an illicit discharge, said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release to minimize the effects of the discharge.

7.2.1 Operational Problems

Property owners are responsible for correcting operational problems that are leading to illegal discharges to the storm drainage system. This could include moving washing activities indoor or undercover, covering material storage areas, locating an appropriate discharge location for liquid wastes, or other operational modifications. Through site visits and education, the City can provide technical assistance to aid property owners in identifying the required modifications.

7.2.2 Structural Problems

Most illicit connection problems will require a structural modification to correct the problem. Structural repairs can be used to redirect discharges such as sewage, industrial, and commercial cross-connections. Such cross-connections must be re-routed to an approved sanitary sewer system. Correcting structural problems is the responsibility of the property owner, though the City may provide technical assistance throughout the process.

7.3 Enforcement Actions

When voluntary compliance does not produce the desired result, the City is required to pursue follow-up enforcement action.

All enforcement actions will be the responsibility of the Development Services Director or their designee. Table 7-1 outlines the detailed enforcement steps. More serious violations or continued non-compliance may warrant a more aggressive, enforcement-oriented approach.

Table 7-1 Illicit Discharge Enforcement Steps

Enforcement Step	Details	Responsibility
Step 1 – Initial Actions	• Provide educational materials (i.e. brochure and copy of City Code Chapter 12, Article II) • Encourage voluntary compliance • Provide summary letter* setting expected compliance date • Additional staff support or technical assistance • Request evidence of corrected problem (if applicable) • Site visit to verify compliance	Development Services Director or Designee
Step 2 – Follow-up Actions	• Send "notice of violation" letter* to property owner regarding unresolved issues • Set second compliance date (determined on individual incident basis) • Site visit to verify compliance	Development Services Director or Designee
Step 3 – Final Actions	• Send second "notice of violation" letter* indicating that unresolved issues will be referred to prosecutor • City may correct problems and send bill to property owner • Levy fines following City Code Chapter 12, Article II or outline community service requirements	Development Services Director or Designee

** Keep copies of all letters within the case log database*

7.3.1 Enforcement Timeline

The timeline of corrective action procedures is highly dependent on the nature of the violation and the responsiveness and cooperation from the person(s) responsible. The urgency of addressing identified problems will be based on the nature of the pollutant in question and potential impacts to downstream waters. Compliance dates should be included in all violation notices.

If abatement of a violation and/or restoration of affected property is required, the notice shall set forth a deadline within which such remediation or restoration must be completed. Said notice shall further advise that, should the violator fail to remediate or restore within the established deadline, the work will be done by a designated governmental agency or a contractor and the expense thereof shall be charged to the violator and may be assessed against the real estate or collected by civil action.

Any person receiving a Notice of Violation may appeal the determination. The Notice of Appeal must be resolved within ten days from the date of the Notice of Violation. Hearing on the appeal before the Director of Public Works or his designee shall take place within 15 days from the date or receipt of the Notice of Appeal. The decision of the Director shall be final.

If property owners are not addressing problems in a timely manner, the City may step in and perform the repairs necessary to remove an illicit connection, eliminate an illicit discharge, and/or clean-up a dumping incident. If the violation has not been corrected as set forth in the notice of violation, or, in the event of an appeal, within 25 days of the original deadline if the director upholds the notice of violation,

then representatives of the city may enter upon the subject private property and are authorized to take any and all measures necessary to abate the violation and/or restore the property. It shall be unlawful for any person, owner, agent, or person in possession of any premises to refuse to allow the city's designees or agents to enter upon the premises. Property owners will also be responsible for reimbursing the City for any costs occurred in correcting IDDE problems.

7.3.2 Potential Fines

Any person violating any provision of this ordinance shall, upon conviction, be guilty of an infraction. Each day shall constitute a separate offense and be punishable by a fine of up to $100.00 per violation per day. Criminal fines shall be in addition to any civil remedies available under Lexington City Code Section 12-54.

7.3.3 Record Keeping

Effective enforcement procedures require comprehensive record keeping and documentation to demonstrate all program steps have been followed. Throughout the problem investigation and corrective action activities, all information related to the incident or property in question should be documented in the case log. Section 8 discusses illicit discharge record keeping in greater detail.

Section 8 – Record Keeping

The sMS4 Permit requires the City to keep records of all stormwater program activities. Thorough record keeping is particularly important for a successful IDDE program. Records of past problems can help focus an investigation in the right direction or identify repeat offenders. Thorough record keeping is also critical to the enforcement process. Examples of the different types of information to be retained are included below:

- **Citizen Complaints** – retain Incident Report Forms
- **Outfall Inspections** – maintain Outfall Inspection Forms, catalog and organize photographs, enter open case logs for suspected problem areas.
- **Investigations** – retain Incident Report forms, photographs, conversation records, and lab testing results.
- **Corrective Action** – in addition to the information collected during the investigation process, retain copies of compliance letters, correspondence with property owners, and proof of corrected problems (contract and invoice for completed work or clean field investigation report).

8.1 Data Sources

Investigations – Illicit discharge investigation records utilize a compliant tracking system developed using Microsoft Excel. A case log is created for each individual compliant call. The system tracks actions completed by the Investigator including: education opportunities, technical assistance, communications, sample collected and enforcement.

Enforcement – The City's Enforcement Response Plan outlined in Section 6 will be the guiding document in determining severity of violation/s and notifications, and range of actions.

8.2 Long Term Record Storage

The sMS4 Permit requires that all IDDE program records be retained for a minimum of five (5) years. However, longer term record storage will be helpful in building a library of data that describes pollutant problems in the City. To facilitate this process, the City will maintain the two most recent inspection reports for each receiving water/outfall location. Case log files (including analytical sampling results) will be kept for at least ten (10) years, or longer as data storage availability allows.

Section 9 – Public Education

The sMS4 Permit requires the City to conduct outreach activities to educate the public and business community about water quality protection. Outreach activities focus on reducing pollutants at the source by educating the public and businesses about their ultimate impact on the natural environment. Many members of the community are apt to modify behaviors once they understand the potential negative consequences.

To date, the City, in cooperation with other Nebraska H20 communities, has conducted outreach activities aimed at educating local residents about preventing stormwater pollution, protecting drinking water, household hazardous waste, water conservation, lawn care, rain barrels, and rain gardens. These programs have been well received by the general public.

The City intends to expand the education efforts and direct more focus to the construction industry with illicit discharge detection and elimination as the focus.

Over the long term, the education program will include two major components. The first will be a business education program focused on informing business owners and their employees of their responsibilities related to water quality protection. The second, longer term, component is the development of a business recognition program aimed at promoting those businesses that are taking active steps to protect water quality (including reducing potential for illicit discharges).

The City's public education will include a prioritization of target businesses, suggested outreach strategies, schedule of activities, and sample outreach materials. The materials will also include a conceptual description of the business recognition program that can be used as a framework for developing the program when funding and staff are available.

Section 10 – Staff Training

The City develops a comprehensive training schedule to meet the requirements of the sMS4 Permit. Two primary trainings have been identified related to IDDE:

- Training for all staff that are routinely in the field to educate them on what constitutes an illicit discharge problem and how to report suspected problems.
- Training for illicit discharge responders on proper identification, investigation, clean-up, disposal, and reporting techniques for illicit discharges.

These trainings are generally conducted by an outside consultant and/or City Staff using materials developed for the IDDE program. The City may use presentations and handouts that are used for conducting the overview training for all field staff. The City will meet permit requirements of having all field staff trained, and the City will schedule follow-up trainings as needed to keep the information fresh or introduce new information acquired during implementation of the IDDE program. These follow-up trainings will typically occur annually.

Training for illicit discharge responders will primarily include distribution and review of this program manual as well as a refresher on City spill response procedures. Follow-up trainings for illicit discharge responders may take the form of debriefings following significant IDDE incidents. Debriefings allow staff to review the actions taken and identify what worked well and what should be modified for future responses.

Section 11 – References

Illicit Discharge Detection and Elimination Guidance Manual, City of Valdosta, GA, May 2016.

Illicit Discharge Detection and Elimination Program Manual, City of Bainbridge Island, April 2010.

Illicit Discharge Detection and Elimination Program Manual, City of Kearney, NE, June 2017.

Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments, Center for Watershed protection and Robert Pitt (University of Alabama), October 2004.

Illicit discharge Detection and Elimination Manual: A Handbook for Municipalities, New England Interstate Water Pollution Control Commission, January 2003.

Investigation of Inappropriate Pollutant Entries into Storm Drainage Systems: A User's Guide, Robert Pitt, et al, EOA publication 600/R-92/238, January 1993.

Appendix A – City of Lexington City Code, Section 12

DIVISION 1. - GENERALLY

Sec. 12-19. - Definitions.

The following words, terms and phrases, when used in this article, shall have the meanings ascribed to them in this section, except where the context clearly indicates a different meaning:

Authorized enforcement agency means the city and its employees or third parties designated to enforce this article.

Best management practices means schedules of activities, prohibitions of practices, general good housekeeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to stormwater, receiving waters or stormwater conveyance systems. The term "best management practices" also includes treatment practices, operating procedures and practices to control site runoff, spillage, leaks, sludge disposal, water disposal or drainage from raw materials storage.

Building phase of development means the period of construction activity when a portion of a common plan of development or sale requires a building permit.

Clean water act means the federal Water Pollution Control Act (33 USC 1251 et seq.), and any subsequent amendments thereto.

Clearing means any activity that removes the vegetative surface cover.

Common plan of development or sale means a contiguous area where multiple separate and distinct land disturbing activities may be taking place at different times, on different schedules, but under one proposed plan which may include, but not be limited to, an announcement or piece of documentation (including a sign, public notice or hearing, sales pitch, advertisement, drawing, permit application, zoning request, computer design, etc.) or physical demarcation (including boundary signs, lot stakes, surveyor markings, etc.) indicating construction activities may occur on a specific plot.

Construction activity means activities subject to National Pollutant Discharge Elimination System construction permits. The term "construction activity" includes, but is not limited to, clearing, grubbing, grading, excavating, demolition and other land disturbing actions.

Construction site means any location where construction activity occurs.

Contractor means any person performing or managing construction work at a construction site, including, but not limited to, any construction manager, general contractor or subcontractor, and any person engaged in any one or more of the following: earthwork, pipe work, paving, building, plumbing, mechanical, electrical, landscaping or material supply.

Disturbed area.

(1) The term "disturbed area" means area of the land's surface disturbed by any work or activity upon the property by means including but not limited to grading, excavating, stockpiling soil, fill, or other materials, clearing, vegetation removal, removal or deposit of any rock, soil, or other materials, or other activities which expose soil.

(2) The term "disturbed area" does not include the tillage of land that is zoned for agricultural use.

Drainage plan means a schematic of the proposed area and how it connects to city's storm sewer system, including proposed location, grade, direction of flow, elevations, drainage structures and drainage areas.

Earthwork means the disturbance of soil on a site associated with construction activities.

Erosion means the detachment and movement of soil or rock fragments by water, wind, ice or gravity.

Erosion and sediment control plan means a plan that indicates the specific measures and sequencing to be used for controlling sediment and erosion on a development site during construction activity according to locally approved standards, specification and guidance.

Erosion control means measures that prevent soil erosion to the maximum extent practicable.

Final stabilization means when all soil disturbing activities at the site have been completed, and vegetative cover has been established with a uniform density of at least 70 percent of predisturbance levels, or equivalent permanent, physical erosion reduction methods have been employed. For purposes of this article, establishment of a vegetative cover capable of providing erosion control equivalent to preexisting conditions at the site is considered final stabilization.

Financial security means a surety bond, performance bond, maintenance bond, irrevocable letter of credit or similar guarantees provided to the city to ensure that a construction stormwater pollution prevention plan is carried out in compliance with requirements of this article.

Hazardous materials means any material, including any substance, waste, or combination thereof, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Illicit connections.

(1) The term "illicit connections" means:

a. Any drain or conveyance, whether on the surface or subsurface, which allows any illicit discharge to enter the storm drainage system including, but not limited to, any conveyance which allows any nonstormwater discharge including sewage, process wastewater, or wash water to enter the storm drainage system.

b. Any connections to the storm drainage system from indoor drains and sinks regardless of whether said drain or connection has been previously allowed, permitted or approved by an authorized enforcement agency.

c. Any drain or conveyance connected from a commercial or industrial land use to the storm drainage system which has not been documented in plans, maps or equivalent records, and approved by an authorized enforcement agency.

(2) The term "illicit connections" does not include connections that have been formerly approved or connections that are allowed under section 12-85.

Illicit discharge means any direct or indirect nonstormwater discharge to the storm drainage system unless exempted by this article.

Industrial activity means activities subject to National Pollutant Discharge Elimination System industrial permits.

Municipal separate storm sewer system means publicly owned facilities by which stormwater is collected and/or conveyed, including but not limited to any roads with drainage systems, municipal streets, gutters, curbs, catchbasins, inlets, piped storm drains, pumping facilities, retention and detention basins, natural and humanmade or altered drainage ditches/channels, reservoirs and other drainage structures.

National Pollutant Discharge Elimination System stormwater discharge permit means a permit issued by Environmental Protection Agency (or by the state authority delegated to it) that authorizes the discharge of pollutants to waters of the United States, whether the permit is applicable on an individual, group or general areawide basis.

NDEQ means the Nebraska Department of Environmental Quality.

NOI means the notice of intent.

Nonstormwater discharge means any discharge to the storm drainage system that is not composed entirely of stormwater.

NOT means the notice of termination.

Operator means the individual who has day-to-day supervision and control of activities occurring at the construction site. This can be the owner, the developer, the general contractor or the agent of one of these parties. It is anticipated that, at different phases of a construction project, different types of parties will satisfy the definition of the term "operator" and the pertinent portions of any applicable permit authorization from the state will be transferred as the roles change.

Outfall means the point of discharge to any watercourse from a public or private stormwater drainage system.

Owner means the person who owns a facility, development, part of a facility or land.

Permittee means the applicant in whose name a valid permit is issued.

Phasing means clearing a parcel of land in distinct phases, with the stabilization of each phase before the clearing of the next.

Pollutant means anything which causes or contributes to pollution. The term "pollutant" includes, but is not limited to:

(1) Paints, varnishes, and solvents;

(2) Oil and other automotive fluids;

(3) Nonhazardous liquid and solid wastes;

(4) Yard wastes;

(5) Refuse, rubbish, garbage, litter, or other discarded or abandoned objects, and accumulations, so that same may cause or contribute to pollution;

(6) Floatables;

(7) Pesticides, herbicides, and fertilizers;

(8) Hazardous substances and wastes;

(9) Sewage, fecal coliform and pathogens;

(10) Dissolved and particulate metals;

(11) Animal wastes;

(12) Wastes and residues that result from constructing a building or structure; and

(13) Noxious or offensive matter of any kind.

Post-construction means the general time period referenced in perpetuity from the approval for final acceptance of the construction phase of any construction activity.

Premises means any building, lot, parcel of land or portion of land, whether improved or unimproved, including adjacent sidewalks and parking strips.

Receiving water means any water of the state, including any and all surface waters that are contained in, or flow in or through the state, all watercourses, even if they are usually dry, irrigation ditches that receive municipal stormwater and storm sewer systems owned by other entities.

Sediment means soil or mud that has been disturbed or eroded and transported naturally by water, wind or gravity or mechanically by any person.

Sediment control means measures that prevent eroded sediment from leaving the site.

Site means the land or water area where any facility or activity is physically located or conducted, including adjacent land used in connection with the facility or activity.

Site plan means a plan or set of plans showing the details of any land disturbance activity of a site including but not limited to the construction of structures, open and enclosed drainage facilities, stormwater management facilities, parking lots, driveways, curbs, pavements, sidewalks, bike paths, recreational facilities, ground covers, plantings and landscaping.

Spill means a release of solid or liquid material, which may cause pollution of the municipal separate storm sewer system or waters of the state.

Stabilization means the use of practices that prevent exposed soil from eroding.

Storm drainage system means publicly owned facilities by which stormwater is collected and/or conveyed, including, but not limited to: any roads with drainage systems; municipal streets; gutters; curbs; inlets; piped storm drains; pumping facilities; retention and detention basins; natural and humanmade or altered drainage channels; reservoirs; and other drainage structures. The storm drainage system in the city is a municipal separate storm sewer system as defined by applicable federal regulations.

Stormwater means any surface flow, runoff or drainage consisting entirely of water from any form of natural precipitation, and resulting from such precipitation.

Stormwater pollution prevention plan means a document which describes the best management practices and activities to be implemented by a person or business to identify sources of pollution or contamination at a site and the actions to eliminate or reduce pollutant discharges to stormwater, stormwater conveyance systems and/or receiving waters, to the maximum extent practicable.

Subdivision development includes activities associated with the platting of any parcel of land into two or more lots and all construction activity taking place thereon.

Utility agency/contractor means private utility companies, public utility departments or other utility providers; contractors working for such private utility companies, public-entity utility departments or other utility providers engaged in the construction or maintenance of utility lines and services, including water, sanitary sewer, storm sewer, electric, gas, telephone, television and communication services.

Wastewater means any water or other liquid, other than uncontaminated stormwater, discharged from any premises or facility. The term "wastewater" includes sewage that is treated at the city's wastewater treatment plant.

Waters of the state means any and all surface and subsurface waters that are contained in, or flow in or through the state. The term "waters of the state" includes all watercourses, even if they are usually dry.

(Ord. No. 2291, § 1(15-2), 2-22-2011)

Sec. 12-20. - Purpose/intent.

The purpose of this article is to provide for the health, safety, and general welfare of the citizens of the city through the regulation of nonstormwater discharges to the storm drainage system to the maximum extent practicable as required by federal and state law. In addition, to control land disturbances, or eliminate soil erosion and sedimentation within the city. This article establishes methods for controlling the introduction of pollutants into the municipal separate storm sewer system in order to comply with requirements of the National Pollutant Discharge Elimination System permit process. The objectives of this article are to:

(1) Regulate the contribution of pollutants to the municipal separate storm sewer system by discharges by any person.

(2) Prohibit illicit connections and discharges to the municipal separate storm sewer system.

(3) Prevent nonstormwater discharges generated as a result of spills, inappropriate dumping or disposal to the city separate storm drainage system.

(4) Reduce pollutants in stormwater discharges from construction activity by guiding, regulating and controlling the design, construction, use and maintenance of any development or other activity that disturbs or breaks the topsoil or results in the movement of earth on land.

(5) Require the construction of locally approved, permanent stormwater runoff controls to protect water quality and maintain nonerosive hydrologic conditions downstream of construction activity and development.

(6) Require responsibility for and long-term maintenance of structural stormwater control facilities and nonstructural stormwater management.

(7) Establish legal authority to carry out all inspection, surveillance and monitoring procedures necessary to ensure compliance with this article.

(Ord. No. 2291, § 1(15-1), 2-22-2011)

Sec. 12-21. - Applicability.

This article shall apply to all water entering the storm drainage system generated on any developed and undeveloped lands unless explicitly exempted.

(Ord. No. 2291, § 1(15-3), 2-22-2011)

Sec. 12-22. - Ultimate responsibility.

The standards set forth herein and promulgated pursuant to this article are minimum standards. Compliance with this article does not act as a waiver or defense to any person for contamination, pollution or unauthorized discharge of pollutants. Ultimate responsibility for prohibited acts rests with persons who own or are in possession or control of premises from which the discharge of contaminates or pollutants emanates.

(Ord. No. 2291, § 1(15-6), 2-22-2011)

Secs. 12-23—12-47. - Reserved.

DIVISION 2. - ADMINISTRATION AND ENFORCEMENT

Sec. 12-48. - Responsibility for administration.

The city shall administer, implement and enforce the provisions of this article. Any powers granted or duties imposed upon the city may be delegated by the city manager to persons or entities acting in the beneficial interest of or in the employ of the city.

(Ord. No. 2291, § 1(15-4), 2-22-2011)

Sec. 12-49. - Notice of violation; compliance order and deadline.

(a) Whenever the city finds that a person has violated or failed to meet a requirement of this article, the city's designee may order compliance by written notice of violation to the responsible person. Such notice may require without limitation:

(1) The performance of monitoring, analyses and reporting;

(2) The elimination of illicit connections or discharges;

(3) The violating discharges, practices or operations shall cease and desist;

(4) The abatement or remediation of stormwater pollution or contamination hazards and the restoration of any affected property;

(5) Payment of costs to cover administrative and remediation expenses;

(6) The implementation of source control, treatment and prevention practices.

(b) If abatement of a violation and/or restoration of affected property is required, the notice shall set forth a deadline within which such remediation or restoration must be completed. Said notice shall further advise that, should the violator fail to remediate or restore within the established deadline, the work will be done by a designated governmental agency or a contractor and the expense thereof shall be charged to the violator and may be assessed against the real estate or collected by civil action.

(Ord. No. 2291, § 1(15-18), 2-22-2011)

Sec. 12-50. - Appeal of notice.

Any person receiving a notice of violation may appeal the determination. The notice of appeal must be received within ten days from the date of the notice of violation. Hearing on the appeal before the director of public works or his designee shall take place within 15 days from the date of receipt of the notice of appeal. The decision of the director shall be final.

(Ord. No. 2291, § 1(15-19), 2-22-2011)

Sec. 12-51. - Enforcement measures.

If the violation has not been corrected as set forth in the notice of violation, or, in the event of an appeal, within 25 days of the original deadline if the director upholds the notice of violation, then representatives of the city may enter upon the subject private property and are authorized to take any and all measures necessary to abate the violation and/or restore the property. It shall be unlawful for any person, owner, agent or person in possession of any premises to refuse to allow the city's designees or agents to enter upon the premises for the purposes set forth in this section.

(Ord. No. 2291, § 1(15-20), 2-22-2011)

Sec. 12-52. - Cost of abatement of the violation.

After abatement of the violation, the owner of the property will be notified of the cost of abatement, including administrative costs. If the amount due is not paid within 30 days, the city may sue to recover the costs through a civil action or levy and assess the costs against the real estate in the manner of special assessments.

(Ord. No. 2291, § 1(15-21), 2-22-2011)

Sec. 12-53. - Violations deemed a public nuisance.

In addition to the enforcement processes and penalties provided, any condition caused or permitted to exist in violation of any of the provisions of this article is a threat to public health, safety and welfare, and is declared and deemed a nuisance, and may be abated or restored at the violator's expense, in the same manner as other nuisances under this Code.

(Ord. No. 2291, § 1(15-23), 2-22-2011)

Sec. 12-54. - Criminal prosecution.

Any person violating any provision of this article shall, upon conviction, be guilty of an infraction. Each day shall constitute a separate offense and be punishable by a fine of $100.00. Criminal fines shall be in addition to any civil remedies available under this Code.

(Ord. No. 2291, § 1(15-24), 2-22-2011)

Sec. 12-55. - Remedies not exclusive.

The remedies listed in this article are not exclusive of any other remedies available under any applicable federal, state or local law and it is within the discretion of the authorized enforcement agency to seek cumulative remedies.

(Ord. No. 2291, § 1(15-25), 2-22-2011)

Secs. 12-56—12-83. - Reserved.

DIVISION 3. - STANDARDS AND REQUIREMENTS

Sec. 12-84. - Illicit discharge.

No person shall discharge or cause to be discharged into the municipal storm drainage system or watercourses any materials including, but not limited to, pollutants or waters containing any pollutants that cause or contribute to a violation of applicable water quality standards. The commencement, conduct or continuance of any illicit discharge to the storm drainage system is prohibited except as described and allowed under section 12-85.

(Ord. No. 2291, § 1(15-7), 2-22-2011)

Sec. 12-85. - Allowed discharge.

The following discharges are exempt from discharge prohibitions established by this article:

(1) Waterline flushing or other potable water sources;

(2) Landscape irrigation or lawn watering;

(3) Diverted stream flows;

(4) Rising groundwater;

(5) Groundwater infiltration to storm drains;

(6) Uncontaminated pumped groundwater;

(7) Foundation or footing drains (not including active groundwater dewatering systems);

(8) Crawl space pumps;

(9) Air conditioning condensation;

(10) Springs;

(11) Noncommercial washing of vehicles;

(12) Natural riparian habitat or wetland flows;

(13) Swimming pools (if dechlorinated, typically less than one ppm chlorine);

(14) Firefighting activities;

(15) Any other water source not containing pollutants;

(16) Discharges determined by the city to be necessary to protect public health and safety;

(17) Dye testing if the city is notified in writing prior to the time of the test; and

(18) Any nonstormwater discharge permitted under a National Pollutant Discharge Elimination System permit, waiver or waste discharge order issued to the discharger and administered under the authority of the Federal Environmental Protection Agency, provided that the discharger is in full compliance with all requirements of the permit, waiver or order, and other applicable laws and regulations, and provided that written approval has been granted for any discharge to the storm drainage system.

(Ord. No. 2291, § 1(15-8), 2-22-2011)

Sec. 12-86. - Illicit connection.

The construction, use, maintenance or continued existence of illicit connections to the storm drainage system is prohibited.

(1) This prohibition expressly includes, without limitation, illicit connections made in the past regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection.

(2) A person is considered to be in violation of this article if the person connects a line conveying sewage or pollutants to the municipal separate storm sewer system or allows such a connection to continue.

(Ord. No. 2291, § 1(15-9), 2-22-2011)

Sec. 12-87. - Suspension of storm drainage system access.

(a) *Due to illicit discharges in emergency situations.* The city may, without prior notice, suspend storm drainage system discharge access to a person when the city deems it necessary to prevent an actual or threatened discharge which presents or may present imminent and substantial danger to: the environment; to the health or welfare of persons or to the storm drainage system; or to waters of the United States of America. If the person fails to comply with a suspension order issued in an emergency, the city may take such steps as deemed necessary to prevent or minimize damage to persons, the storm drainage system, or the waters of the United States of America.

(b) *Due to the detection of illicit discharge.* Any person discharging to the storm drainage system in violation of this article may have their storm drainage system access terminated if such termination would abate or reduce an illicit discharge. The city will notify a person of the proposed termination of storm drainage system access by personal delivery or by United States mail. The person may request a hearing before the city director of public works by delivering such request in writing to the city clerk. The person is not entitled to a stay of the termination pending any such hearing.

(c) *Offense.* A person commits an offense if the person accesses or attempts to access the storm drainage system from premises terminated pursuant to this section, without the prior approval of the city.

(Ord. No. 2291, § 1(15-10), 2-22-2011)

Sec. 12-88. - Construction.

(a) *General requirements for construction activities.*

(1) Except for construction activity relating to the building phase of development, the city shall require proof of coverage by a NDEQ general permit authorization for stormwater discharges from construction sites before providing approval for construction activity and land developments requiring, including, but not limited to, site plan applications, subdivision applications, building applications, and right-of-way applications from the city, unless exempt pursuant to this subsection (a)(1). These provisions apply to all portions of any plan for land disturbing activity which would cause the disturbance of at least one acre of soil even though multiple, separate and distinct land development activities within the overall development may take place at different times on different schedules. The following activities are exempt from this article:

a. Any emergency activity that is necessary for the immediate protection of life, property or natural resources; and

b. Construction activity that provides maintenance and repairs performed to maintain the original line and grade, hydraulic capacity or original purpose of a facility.

(2) The city shall be invited to the preconstruction meeting to review the installation of all temporary erosion and sediment control BMPs included on the approved erosion and sediment control plan at least two business days before any construction activities are scheduled to start.

(3) Solid waste, industrial waste, yard waste and any other pollutants or waste on any construction site shall be controlled through the use of BMPs. Waste or recycling containers shall be provided and maintained by the owner or contractor on construction sites where there is the potential for release of waste. Uncontained waste that may blow, wash or otherwise be released from the site is prohibited. Sanitary waste facilities shall be provided and maintained in a secured manner.

(4) Ready-mixed concrete, or any materials resulting from the cleaning of vehicles or equipment containing such materials or used in transporting or applying ready-mixed concrete, shall not be allowed to discharge from any construction site. Concrete wasted on site must be disposed in a manner consistent with locally approved standards and generally require establishment of a designated washout area.

(5) Cover or perimeter control shall be applied within 14 days to any soil stockpiles, which will remain undisturbed for longer than 30 calendar days.

(6) Disturbed soil shall be managed with BMPs that are adequately designed, installed and maintained according to locally approved technical standards, specifications and guidance for the duration of the construction activity to minimize erosion and contain sediment within the construction limits.

(7) Sediment tracked or discharged onto public right-of-way shall be removed immediately.

(8) Bulk storage structures for petroleum products and other chemicals shall have adequate protection to contain all spills and prevent any spilled material from entering the MS4 or waters of the state.

(9) Temporary BMPs shall be removed and disturbed areas shall be stabilized with permanent BMPs at the conclusion of construction activity.

(b) *Requirements for the building phase of development.*

(1) Any person who engages in construction activity is responsible for compliance with this article and all applicable terms and conditions of the approved construction activity and SWPPP as it relates to the building phase of development. The following information shall be included with the application for a building permit and be submitted to the public works department:

a. Either the legal description and NPDES permit number for the larger common plan of development; or

b. The location of the property where the building phase of development is to occur; and

(2) Contractor acknowledgement that the building phase of development for the property described on the application for a building permit will be conducted in conformance with this article and the construction activity SWPPP.

(c) *Construction stormwater pollution prevention plan.*

(1) A SWPPP shall be prepared and updated in accordance with locally approved technical standards, specification, and guidance for construction activity within the city and shall include an erosion and sediment control plan for land disturbance.

(2) The SWPPP shall include a description of all potential pollution sources, temporary and permanent BMPs that will be implemented at the site as approved by the city.

(3) The erosion and sediment control plan shall be submitted to the city for review with any application covered in subsection (a)(1) of this section.

(4) Land disturbing activities may not proceed until approval of the erosion and sediment control plan is provided by the city.

(5) The owner or operator is required to have a copy of the SWPPP readily available or on site for review with content that reflects the current condition of the construction activity and all records that demonstrate compliance and are required by this article.

(6) The SWPPP shall include descriptions of routine site inspections as follows:

a. The owner or their representative shall inspect all BMPs at intervals of no greater than 14 calendar days and within 24 hours after any precipitation event of at least one-half inch.

b. Inspections of BMPs shall be conducted by an individual knowledgeable in the principles and practice of erosion and sediment controls who possesses the skills to assess conditions at the construction site that could impact stormwater quality and to assess the effectiveness of any erosion and sediment control measures selected to control the quality of stormwater discharges from the construction activity.

c. Inspection reports shall provide the name and qualification of the inspector, date of the evaluation, risks to stormwater quality identified and all corrective actions necessary to prevent stormwater pollution.

d. The owner or operator of a construction activity may be requested to submit copies of inspection reports for review on a periodic basis by the city.

(7) Based on inspections performed by the owner, operator, authorized city personnel, state or federal regulators, modifications to the SWPPP will be necessary if at any time the specified BMPs do not meet the objectives of this article. In this case, the owner shall meet with an appointed official of the city to determine the appropriate modifications. All required modifications shall be completed within seven calendar days of receiving notice of inspection findings, and shall be recorded in the SWPPP.

(8) The owner or operator of a construction site shall be responsible for amending the SWPPP whenever there is a significant change in design, construction, operation or maintenance, which has a significant effect on the potential for discharge of pollutants to the MS4 or receiving waters, or if the SWPPP proves to be ineffective in achieving the general objectives of controlling pollutants in stormwater discharges associated with land disturbance.

(9) Records of inspection are to be maintained with the SWPPP for the life of the project. Inspection records are to be available to city inspectors upon request. Delay in providing a copy of the SWPPP or any requested records shall constitute a violation of this article.

(d) *Requirements for utility construction.*

(1) Utility agencies or their representatives shall develop and implement BMPs to prevent the discharge of pollutants on any site of utility construction within the city. The city may require additional BMPs on utility construction activity. If the utility construction disturbs greater than one acre, the utility agency must comply with the requirements of subsections (a) and (b) of this section.

(2) Utility agencies or their representatives shall implement BMPs to prevent the release of sediment from utility construction sites. Disturbed areas shall be minimized, disturbed soil shall be managed and construction site exits shall be managed to prevent sediment tracking. Sediment tracked onto public right-of-way shall be removed immediately.

(3) Prior to entering a construction site or subdivision development, utility agencies or their representatives shall obtain and comply with any approved erosion and sediment control plans for the project. Any impact to construction and post-construction BMPs resulting from utility construction shall be evaluated prior to disturbance by the developer and utility company. Repairs to the disturbed BMPs must be completed within 48 hours, by individuals agreed upon during the design phase or at a preconstruction meeting.

(Ord. No. 2291, § 1(15-11), 2-22-2011)

Sec. 12-89. - Post-construction of permanent BMPs.

(a) *Requirements.*

(1) Land development that meets the requirements of section 12-88(a)(1) must address stormwater runoff quality through the use of permanent BMPs. Permanent BMPs shall be provided for in the drainage plan for any subdivision plat, annexation plat, development agreement, subdivision agreement or other local development plan.

(2) Structural BMPs located on private property shall be owned and operated by the owners of the property on which the BMP is located; unless the city agrees in writing that a person or entity other than the owner shall own or operate such BMP. As a condition of approval of the BMP, the owner shall also agree to maintain the BMP in perpetuity to its design capacity unless or until the city shall relieve the property owner of that responsibility in writing. The obligation to maintain the BMP shall be memorialized on the subdivision plat, annexation plat, development agreement, subdivision agreement or other form acceptable to the city and shall be recorded with the city public works department.

(b) *Completion.* Upon completion of a project, the city shall be provided a written certification stating that the completed project is in compliance with the approved final drainage plan. All applicants are required to submit as-built plans for any permanent BMPs once final construction is completed and must be signed by a professional engineer licensed in the state.

(c) *Ongoing inspection and maintenance.*

(1) The owner of site must, unless an on-site stormwater management facility or practice is dedicated to and accepted by the city, execute an inspection and maintenance agreement, that shall be binding on all subsequent owners of the permanent BMPs.

(2) Permanent BMPs included in a drainage plan which is subject to an inspection and maintenance agreement must undergo ongoing inspections to document maintenance and repair needs and to ensure compliance with the requirements of the agreement, the plan and this article.

(Ord. No. 2291, § 1(15-12), 2-22-2011)

Sec. 12-90. - Technical standards, specifications, and guidance.

All BMPs designed to meet the requirements of this article shall reference the appropriate technical standards, specifications and guidance as follows:

(1) City standards and specifications for construction.

(2) State department of roads drainage design and erosion control standards, specifications and guidance.

(3) Any other alternative methodology approved by the city, which is demonstrated to be effective.

(Ord. No. 2291, § 1(15-13), 2-22-2011)

Sec. 12-91. - Monitoring of discharges.

(a) *Applicability.* This section applies to all premises that have stormwater discharges associated with industrial activity, including construction activity.

(b) *Access to premises.*

(1) The city's designees shall be permitted to enter and inspect premises and facilities subject to regulation under this article as often as may be necessary to determine compliance with this article. If a discharger has security measures in force which require proper identification and clearance before entry into its premises, the discharger shall make the necessary arrangements to allow access to representatives of the city.

(2) The city's designees shall be given access to all parts of the premises for the purposes of: inspection, sampling, examination and copying of records that must be kept under the

conditions of the National Pollutant Discharge Elimination System permit to discharge stormwater, and the performance of any additional duties as defined by state and federal law.

(3) The city may place upon the premises such devices as deemed necessary to conduct monitoring and/or sampling of discharges from the premises.

(4) The city may require a person to install monitoring equipment as necessary. Sampling and monitoring equipment shall be maintained at all times in a safe and proper operating condition at no expense to the city. All devices used to measure stormwater flow and quality shall be calibrated to ensure accuracy.

(5) Any obstruction to safe and easy access to the premises to be inspected and/or sampled shall be promptly removed at the request of the city and shall not be replaced. The costs of clearing such access shall not be paid by the city.

(6) Unreasonable delays in allowing city designees access to premises is a violation of a stormwater discharge permit and of this article. A person who is the operator of a facility or premises with a National Pollutant Discharge Elimination System permit to discharge stormwater associated with industrial activity commits an offense if the person denies the city reasonable access for the purpose of conducting any activity authorized or required by this article.

If a city designee has been refused access to any part of the premises from which stormwater is discharged, the city may seek issuance of a search warrant from any court of competent jurisdiction.

(Ord. No. 2291, § 1(15-14), 2-22-2011)

Sec. 12-92. - Best management practices.

The city may adopt requirements identifying best management practices for any activity, operation, or facility which may cause or contribute to pollution or contamination of stormwater, the storm drainage system or the waters of the United States of America. The owner or operator of a commercial or industrial establishment shall provide, at the owner or operator's expense, reasonable protection from the discharge of prohibited materials or other wastes into the municipal storm drainage system or watercourses through the use of these structural and nonstructural best management practices. Further, any person responsible for a property or premises, which is, or may be, the source of an illicit discharge, may be required to implement, at said person's expense, additional structural and nonstructural best management practices to prevent the further discharge of pollutants to the municipal separate storm sewer system. These best management practices shall be part of a stormwater pollution prevention plan as necessary for compliance with requirements of any National Pollutant Discharge Elimination System permit.

(Ord. No. 2291, § 1(15-15), 2-22-2011)

Sec. 12-93. - Watercourse protection.

Every person owning property through which a watercourse passes, and such person's lessee, shall keep and maintain that part of the watercourse within the property free of trash, debris, excessive vegetation and other obstacles that would pollute, contaminate or significantly retard the flow of water through the watercourse. In addition, the owner or lessee shall maintain existing privately owned structures within or adjacent to a watercourse, so that such structures will not become a hazard to the use, function or physical integrity of the watercourse.

(Ord. No. 2291, § 1(15-16), 2-22-2011)

Sec. 12-94. - Notification of discharges and spills.

Notwithstanding other requirements of law, as soon as any person responsible for a facility, premises or operation, has information of any known or suspected release of materials which result or may result in illegal discharges or pollutants discharging into stormwater, the storm drainage system, or the waters of the United States of America, said person shall take all necessary steps to ensure the discovery,

containment and cleanup of such release. In the event of such release of hazardous materials, said person shall immediately notify emergency response agencies and the city of the occurrence via emergency dispatch services. In the event of a release of nonhazardous materials, said person shall notify the city in person or by phone or facsimile no later than the next business day. Notifications in person, by phone or by facsimile shall be confirmed by written notice addressed and mailed to the city within three business days of the prior notice. If the discharge of prohibited materials emanates from a commercial or industrial establishment, the owner or operator of such establishment shall also retain an on-site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three years.

(Ord. No. 2291, § 1(15-17), 2-22-2011)

Appendix B – IDDE Incident Report Form

Initial IDDE Report Form
Illlicit Discharge Incident Tracking Sheet

Reporting Information

Caller Name:	
Caller Phone Number:	Incident Time:
Closest street address/intersection OR Nearest Landmark/Building:	

Questions (*Required)

Known discharge?*	☐ Yes	☐ No
IF YES:		
Discharge name:		
Amount spilled:		
Has the leak stopped?*	☐ Yes	☐ No
Has discharge been released to a storm drain/waterway?*	☐ Yes	☐ No
IF YES:		
Narrative Description of Location (i.e. near storm drains, in creek/river, along river bank):		

For Unknown Discharge

Check all characteristics that apply to the unknown discharge:

Appearance	☐ Normal	☐ Oil (Rainbow) Sheen	☐ Cloudy	☐ Soapy/Sudsy
	☐ Colored	☐ Other (describe):		
Odor	☐ None	☐ Sewage	☐ Rancid/Sour	☐ Petroleum/Gas
	☐ Sulfide (rotten eggs), Natural gas		☐ Other:	
Floatables	☐ None	☐ Sewage (toilet paper, etc.)	☐ Algae	☐ Dead Fish
	☐ Other (describe):			

Other Comments:

☐ **Chemical** ☐ **Water/Sewer**

Operator Name:	Incident Date:

Appendix C – Outfall Reconnaissance Inventory (ORI) Field Sheet

OUTFALL RECONNAISSANCE INVENTORY/ SAMPLE COLLECTION FIELD SHEET

Section 1: Background Data

Subwatershed:		Outfall ID:	
Today's date:		Time (Military):	
Investigators:		Form completed by:	
Temperature (°F):	Rainfall (in.): Last 24 hours: Last 48 hours:		
Latitutde:	Longitude:	GPS Unit:	GPS LMK #:
Camera:		Photo #s:	

Land Use in Drainage Area (Check all that apply):

☐ Industrial ☐ Open Space

☐ Ultra-Urban Residential ☐ Institutional

☐ Suburban Residential Other: _____

☐ Commercial Known Industries: _____

Notes (e.g.., origin of outfall, if known):

Section 2: Outfall Description

LOCATION	MATERIAL	SHAPE		DIMENSIONS (IN.)	SUBMERGED
☐ **Closed Pipe**	☐ RCP ☐ CMP ☐ PVC ☐ HDPE ☐ Steel ☐ Other: _____	☐ Circular ☐ Eliptical ☐ Box ☐ Other: _____	☐ Single ☐ Double ☐ Triple ☐ Other: _____	Diameter/Dimensions: _____	In Water: ☐ No ☐ Partially ☐ Fully With Sediment: ☐ No ☐ Partially ☐ Fully
☐ **Open drainage**	☐ Concrete ☐ Earthen ☐ rip-rap ☐ Other: _____	☐ Trapezoid ☐ Parabolic ☐ Other: _____		Depth: _____ Top Width: _____ Bottom Width: _____	
☐ **In-Stream**	**(applicable when collecting samples)**				
Flow Present?	☐ Yes ☐ No	***If No, Skip to Section 5***			
Flow Description (If present)	☐ Trickle ☐ Moderate ☐ Substantial				

Section 3: Quantitative Characterization

FIELD DATA FOR FLOWING OUTFALLS				
PARAMETER		**RESULT**	**UNIT**	**EQUIPMENT**
☐Flow #1	Volume		Liter	Bottle
	Time to fill		Sec	
☐Flow #2	Flow depth		In	Tape measure
	Flow width	_____' _____"	Ft, In	Tape measure
	Measured length	_____' _____"	Ft, In	Tape measure
	Time of travel		S	Stop watch
Temperature			°F	Thermometer
pH			pH Units	Test strip/Probe
Ammonia			mg/L	Test strip

Outfall Reconnaissance Inventory Field Sheet

Section 4: Physical Indicators for Flowing Outfalls Only

Are Any Physical Indicators Present in the flow? ☐ Yes ☐ No *(If No, Skip to Section 5)*

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)

Section 5: Physical Indicators for Both Flowing and Non-Flowing Outfalls

Are physical indicators that are not related to flow present? ☐ Yes ☐ No *(If No, Skip to Section 6)*

INDICATOR	CHECK if Present	DESCRIPTION	COMMENTS
Outfall Damage	☐	☐ Spalling, Cracking or Chipping ☐ Peeling Paint ☐ Corrosion	
Deposits/Stains	☐	☐ Oily ☐ Flow Line ☐ Paint ☐ Other:	
Abnormal Vegetation	☐	☐ Excessive ☐ Inhibited	
Poor pool quality	☐	☐ Odors ☐ Colors ☐ Floatables ☐ Oil Sheen ☐ Suds ☐ Excessive Algae ☐ Other:	
Pipe benthic growth	☐	☐ Brown ☐ Orange ☐ Green ☐ Other:	

Section 6: Overall Outfall Characterization

☐ Unlikely ☐ Potential (presence of two or more indicators) ☐ Suspect (one or more indicators with a severity of 3) ☐ Obvious

Section 7: Data Collection

1.	Sample for the lab?	☐ Yes	☐ No	
2.	If yes, collected from:	☐ Flow	☐ Pool	
3.	Intermittent flow trap set?	☐ Yes	☐ No	If Yes, type: ☐ OBM ☐ Caulk dam

Section 8: Any Non-Illicit Discharge Concerns (e.g., trash or needed infrastructure repairs)?

Appendix D – Center for Watershed Protection IDDE Manual – Chapter 11: The Outfall Reconnaissance Inventory

Chapter 11: The Outfall Reconnaissance Inventory

This chapter describes a simple field assessment known as the Outfall Reconnaissance Inventory (ORI). The ORI is designed to fix the geospatial location and record basic characteristics of individual storm drain outfalls, evaluate suspect outfalls, and assess the severity of illicit discharge problems in a community. Field crews should walk all natural and man-made streams channels with perennial and intermittent flow, even if they do not appear on available maps (Figure 19). The goal is to complete the ORI on every stream mile in the MS4 within the first permit cycle, starting with priority subwatersheds identified during the desktop analysis. The results of the ORI are then used to help guide future outfall monitoring and discharge prevention efforts.

11.1 Getting Started

The ORI requires modest mapping, field equipment, staffing and training resources. A complete list of the required and optional resources needed to perform an ORI is presented in Table 30. The ORI can be combined with other stream assessment tools, and may be supplemented by simple indicator monitoring. Ideally, a Phase II community should plan on surveying its entire drainage network at least once over the course of each five-year permit cycle. Experience suggests that it may take up to three stream walks to identify all outfalls.

Figure 19: Walk all streams and constructed open channels

Best Times to Start

Timing is important when scheduling ORI field work. In most regions of the country, spring and fall are the best seasons to perform the ORI. Other seasons typically have challenges such as over-grown vegetation or high groundwater that mask illicit discharges, or make ORI data hard to interpret[9].

Prolonged dry periods during the non-growing season with low groundwater levels are optimal conditions for performing an ORI. Table 31 summarizes some of the regional factors to consider when scheduling ORI surveys in your community. Daily weather patterns also determine whether ORI field work should proceed. In general, ORI field work should be conducted at least 48 hours after the last runoff-producing rain event.

Field Maps

The field maps needed for the ORI are normally generated during the desktop assessment phase of the IDDE program described in Chapter 5. This section

[9] Upon initial program start-up, the ORI should be conducted during periods of low groundwater to more easily identify likely illicit discharges. However, it should be noted that high water tables can increase sewage contamination in storm drain networks due to infiltration and inflow interactions. Therefore, in certain situations, seasonal ORI surveys may be useful at identifying these types of discharges. Diagnosis of this source of contamination, however, can be challenging.

Table 30: Resources Needed to Conduct the ORI		
Need Area	**Minimum Needed**	**Optional but Helpful**
Mapping	• Roads • Streams	• Known problem areas • Major land uses • Outfalls • Specific industries • Storm drain network • SIC-coded buildings • Septics
Field Equipment	• 5 one-liter sample bottles • Backpack • Camera (preferably digital) • Cell phones or hand-held radios • Clip boards and pencils • Field sheets • First aid kit • Flash light or head lamp • GPS unit • Spray paint (or other marker) • Surgical gloves • Tape measure • Temperature probe • Waders (snake proof where necessary) • Watch with a second hand	• Portable Spectrophotometer and reagents (can be shared among crews) • Insect repellant • Machete/clippers • Sanitary wipes or biodegradable soap • Wide-mouth container to measure flow • Test strips or probes (e.g., pH and ammonia)
Staff	• Basic training on field methodology • Minimum two staff per crew	• Ability to track discharges up the drainage system • Knowledge of drainage area, to identify probable sources. • Knowledge of basic chemistry and biology

Table 31: Preferred Climate/Weather Considerations for Conducting the ORI		
Preferred Condition	**Reason**	**Notes/Regional Factors**
Low groundwater (e.g., very few flowing outfalls)	High groundwater can confound results	In cold regions, do not conduct the ORI in the early spring, when the ground is saturated from snowmelt.
No runoff-producing rainfall within 48 hours	Reduces the confounding influence of storm water	The specific time frame may vary depending on the drainage system.
Dry Season	Allows for more days of field work	Applies in regions of the country with a "wet/ dry seasonal pattern." This pattern is most pronounced in states bordering or slightly interior to the Gulf of Mexico or the Pacific Ocean.
Leaf Off	Dense vegetation makes finding outfalls difficult	Dense vegetation is most problematic in the southeastern United States. This criterion is helpful but not required.

provides guidance on the basic requirements for good field maps. First, ORI field maps do not need to be fancy. The scale and level of mapping detail will vary based on preferences and navigational skills of field crews. At a minimum, maps should have labeled streets and hydrologic features (USGS blue line streams, wetlands, and lakes), so field crews can orient themselves and record their findings spatially.

Field maps should delineate the contributing drainage area to major outfalls, but only if they are readily available. Urban landmarks such as land use, property boundaries, and storm drain infrastructure are also quite useful in the field. ORI field maps should be used to check the accuracy and quality of pre-existing mapping information, such as the location of outfalls and stream origins.

Basic street maps offer the advantage of simplicity, availability, and well-labeled road networks and urban landmarks. Supplemental maps such as a 1": 2000' scale USGS Quad sheet or finer scale aerial photograph are also recommended for the field. USGS Quad sheets are readily available and display major transportation networks and landmarks, "blue line" streams, wetlands, and topography. Quad maps may be adequate for less developed subwatersheds, but are not always accurate in more urban subwatersheds.

Recent aerial photographs may provide the best opportunity to navigate the subwatershed and assess existing land cover. Aerial photos, however, may lack topography and road names, can be costly, and are hard to record field notes on due to their darkness. GIS-ready aerial photos and USGS Quad sheets can be downloaded from the internet or obtained from local planning, parks, or public works agencies.

Field Sheets

ORI field sheets are used to record descriptive and quantitative information about each outfall inventoried in the field. Data from the field sheets represent the building blocks of an outfall tracking system allowing program managers to improve IDDE monitoring and management. A copy of the ORI field sheet is provided in Appendix D, and is also available as a Microsoft Word™ document. Program managers should modify the field sheet to meet the specific needs and unique conditions in their community.

Field crews should also carry an authorization letter and a list of emergency phone numbers to report any emergency leaks, spills, obvious illicit discharges or other water quality problems to the appropriate local authorities directly from the field. Local law enforcement agencies may also need to be made aware of the field work. Figure 20 shows an example of a water pollution emergency contact list developed by Montgomery County, MD.

Equipment

Basic field equipment needed for the ORI includes waders, a measuring tape, watch, camera, GPS unit, and surgical gloves (see Table 30). GPS units and digital cameras are usually the most expensive equipment items; however, some local agencies may already have them for other applications. Adequate ranging, water-resistant, downloadable GPS units can be purchased for less than $150. Digital cameras are preferred and can cost between $200 and $400, however, conventional or disposable cameras can also work, as long as they have flashes. Hand-held data recorders and customized software can be used to record text, photos, and GPS coordinates electronically in the field. While

these technologies can eliminate field sheets and data entry procedures, they can be quite expensive. Field crews should always carry basic safety items, such as cell phones, surgical gloves, and first aid kits.

Staffing

The ORI requires at least a two-person crew, for safety and logistics. Three person crews provide greater safety and flexibility, which helps divide tasks, allows one person to assess adjacent land uses, and facilitates tracing outfalls to their source. All crew members should be trained on how to complete the ORI and should have a basic understanding of illicit discharges and their water quality impact. ORI crews can be staffed by trained volunteers, watershed groups and college interns. Experienced crews can normally expect to cover two to three stream miles per day, depending on stream access and outfall density.

11.2 Desktop Analysis to Support the ORI

Two tasks need to be done in the office before heading out to the field. The major ORI preparation tasks include estimating the total stream and channel mileage in the subwatershed and generating field maps. The total mileage helps program managers scope out how long the ORI will take and how much it will cost. As discussed before, field maps are an indispensable navigational aid for field crews working in the subwatershed.

Delineating Survey Reaches

ORI field maps should contain a preliminary delineation of **survey reaches**. The stream network within your subwatershed should be delineated into discrete segments of relatively uniform character. Delineating survey reaches provides good stopping and starting points for field crews, which

WATER POLLUTION PHONE NUMBERS TO CALL WHEN A WATER QUALITY PROBLEM IS OBSERVED or TO OBTAIN FURTHER INFORMATION ABOUT WATER QUALITY ISSUES
Spring 2001

COUNTY AGENCIES

DEP: Department of Environmental Protection
DEPC: Division of Environmental Policy & Compliance
WMD: Watershed Management Division

DPS: Department of Permitting Services
LDS: Land Development Services
SWM: Stormwater Management
WS: Wells & Septic

INTER-COUNTY AGENCIES

MNCPPC: Maryland-National Capital Park & Planning Commission
WSSC: Washington Suburban Sanitary Commission
DHCD: Department of Housing & Community Development
DPWT: Department of Public Works & Transportation

PROBLEM/QUESTION	AGENCY & TELEPHONE NUMBER	
ILLEGAL DUMPING HOTLINE	**DEPC:**	**240-777-7700** Daytime hours ←
	→ Nighttime hours	**240/777-DUMP (3867) or 240-777-7788**
Blocked storm drain, inlet or pipe or erosion from public storm drain	DPWT:	240/777-ROAD (7623) Highway Maintenance)
Discolored public drinking water, odor to drinking water		301/206-4002
Erosion, flooding, drainage problems between private properties	DHCD:	240/777-3600 (Code Enforcement)
Erosion - stream banks on park land	MNCPPC:	301/495-2535
Fire & Rescue Services (emergencies: 911)	(Non-Emergencies):	240/777-0744
Recycling Programs/Special pick up services	DPWT:	240/777-6400 or 6466
Sanitary sewer problems	WSSC:	301/206-4002
Sediment (mud) from construction site entering streams	LDS:	240/777-6366
Septic Leaks/ Septic Tanks	WS:	240/777-6300
Stormwater Management, pond safety and maintenance	DEPC:	240/777-7744
Stormwater Management and Sediment Control Plan Review issues	SWM:	240/777-6320
Stream Clean-ups	WMD:	240/777-7712
Swimming Pool Discharges	DEPC:	240/777-7770
Trash and debris in parks and streams	MNCPPC:	301/495-2535
Water main break	WSSC:	301/206-4002
Water pollution	DEPC:	240/777-7770
(discharging, dumping, chemical spills into streams or storm drains)	LDS:	240/777-6260
Water quality monitoring programs for schools (Stream Teams)	WMD:	240/777-7714
Wells and Well Inspections	WS:	240/777-6300

askDEP.com

Figure 20: Example of a comprehensive emergency contact list for Montgomery County, MD

is useful from a data management and logistics standpoint. Each survey reach should have its own unique identifying number to facilitate ORI data analysis and interpretation. Figure 21 illustrates some tips for delineating survey reaches, and additional guidance is offered below:

- Survey reaches should be established above the confluence of streams and between road crossings that serve as a convenient access point.
- Survey reaches should be defined at the transition between major changes in land use in the stream corridor (e.g. forested land to commercial area).
- Survey reaches should generally be limited to a quarter mile or less in length. Survey reaches in lightly developed subwatersheds can be longer than those in more developed subwatersheds, particularly if uniform stream corridor conditions are expected throughout the survey reach.
- Access through private or public property should be considered when delineating survey reaches as permission may be required.

It should be noted that initial field maps are not always accurate, and changes may need to be made in the field to adjust survey reaches to account for conditions such as underground streams, missing streams or long culverts. Nevertheless, upfront time invested in delineating survey reaches makes it easier for field crews to perform the ORI.

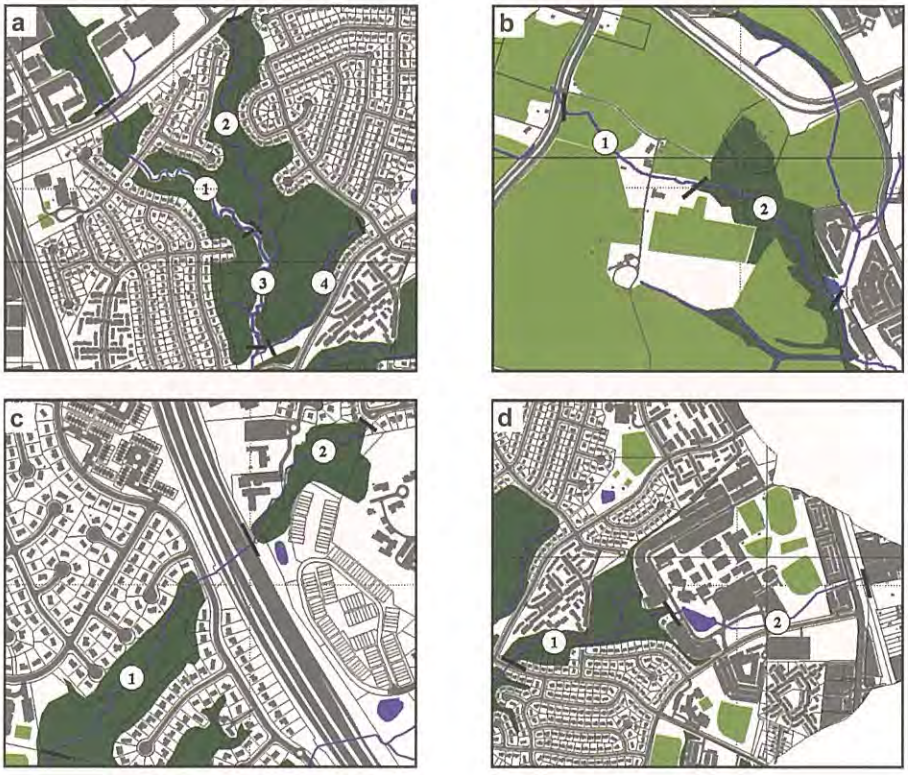


Figure 21: Various physical factors control how survey reaches are delineated. (a) Survey reaches based on the confluence of stream tributaries. (b) A long tributary split into ¼ mile survey reaches. (c) Based on a major road crossing (include the culvert in the downstream reach). (d) Based on significant changes in land use (significant changes in stream features often occur at road crossings, and these crossings often define the breakpoints between survey reaches).

11.3 Completing the ORI

Field crews conduct an ORI by walking all streams and channels to find outfalls, record their location spatially with a GPS unit and physically mark them with spray paint or other permanent marker. Crews also photograph each outfall and characterize its dimensions, shape, and component material, and record observations on basic sensory and physical indicators. If dry weather flow occurs at the outfall, additional flow and water quality data are collected. Field crews may also use field probes or test strips to measure indicators such as temperature, pH, and ammonia at flowing outfalls.

The ORI field sheet is divided into eight sections that address both flowing and non-flowing outfalls (Appendix D). Guidance on completing each section of the ORI field sheet is presented below.

Outfalls to Survey

The ORI applies to **all** outfalls encountered during the stream walk, regardless of diameter, with a few exceptions noted in Table 32. Common outfall conditions seen in communities are illustrated in Figure 22 As a rule, crews should only omit an outfall if they can definitively conclude it has no potential to contribute to a transitory illicit discharge. While EPA's Phase I guidance only targeted major outfalls (diameter of 36 inches or greater), documenting all outfalls is recommended, since smaller pipes make up the majority of all outfalls and frequently have illicit discharges (Pitt *et al.*, 1993 and Lalor, 1994). A separate ORI field sheet should be completed for each outfall.

Table 32: Outfalls to Include in the Screening

Outfalls to Record	Outfalls to Skip
• Both large and small diameter pipes that appear to be part of the storm drain infrastructure • Outfalls that appear to be piped headwater streams • Field connections to culverts • Submerged or partially submerged outfalls • Outfalls that are blocked with debris or sediment deposits • Pipes that appear to be outfalls from storm water treatment practices • Small diameter ductile iron pipes • Pipes that appear to only drain roof downspouts but that are subsurface, preventing definitive confirmation	• Drop inlets from roads in culverts (unless evidence of illegal dumping, dumpster leaks, etc.) • Cross-drainage culverts in transportation right-of-way (i.e., can see daylight at other end) • Weep holes • Flexible HDPE pipes that are known to serve as slope drains • Pipes that are clearly connected to roof downspouts via above-ground connections

Ductile iron round pipe

4-6" HDPE; Check if roof leader connection (legal)

Field connection to inside of culvert; Always mark and record.

Small diameter (<2") HDPE; Often a sump pump (legal), or may be used to discharge laundry water (illicit).

Elliptical RCP; Measure both horizontal and vertical diameters.

Double RCP round pipes; Mark as separate outfalls unless known to connect immediately up-pipe

Culvert (can see to other side); Don't mark as an outfall

Open channel "chute" from commercial parking lot; Very unlikely illicit discharge. Mark, but do not return to sample (unless there is an obvious problem).

Small diameter PVC pipe; Mark, and look up-pipe to find the origin.

CMP outfall; Crews should also note upstream sewer crossing.

Box shaped outfall

CMP round pipe with two weep holes at bridge crossing. (Don't mark weep holes)

Figure 22: Typical Outfall Types Found in the Field

Obvious Discharges

Field crews may occasionally encounter an obvious illicit discharge of sewage or other pollutants, typified by high turbidity, odors, floatables and unusual colors. When obvious discharges are encountered, field crews should STOP the ORI survey, track down the source of the discharge and immediately contact the appropriate water pollution agency for enforcement. Crews should photo-document the discharge, estimate its flow volume and collect a sample for water quality analysis (if this can be done safely). All three kinds of evidence are extremely helpful to support subsequent enforcement. Chapter 13 provides details on techniques to track down individual discharges.

11.4 ORI Section 1 - Background Data

The first section of the ORI field sheet is used to record basic data about the survey, including time of day, GPS coordinates for the outfall, field crew members, and current and past weather conditions (Figure 23). Much of the information in this section is self-explanatory, and is used to create an accurate record of when, where, and under what conditions ORI data were collected.

Every outfall should be photographed and marked by directly writing a unique identifying number on each outfall that serves as its subwatershed "address" (Figure 24). Crews can use spray paint or another temporary marker to mark outfalls, but may decide to replace temporary markings with permanent ones if the ORI is repeated later. Markings help crews confirm outfall locations during future investigations, and gives citizens a better way to report the location of spills or discharges when calling a water pollution hotline. Crews should mark the spatial location of all outfalls they encounter directly on field maps, and record the coordinates with a GPS unit that is accurate to within 10 feet. Crews should take a digital photo of each outfall, and record photo numbers in Section 1 of the field sheet.

Section 1: Background Data

Subwatershed:		Outfall ID:	
Today's date:		Time (Military):	
Investigators:		Form completed by:	
Temperature (°F):	Rainfall (in.): Last 24 hours: Last 48 hours:		
Latitude:	Longitude:	GPS Unit:	GPS LMK #:
Camera:		Photo #s:	
Land Use in Drainage Area (Check all that apply):			
☐ Industrial		☐ Open Space	
☐ Ultra-Urban Residential		☐ Institutional	
☐ Suburban Residential		Other: _____	
☐ Commercial		Known Industries: _____	
Notes (e.g., origin of outfall, if known):			

Figure 23: Section 1 of the ORI Field Sheet

Figure 24: Labeling an outfall (a variety of outfall naming conventions can be used)

The land use of the drainage area contributing to the outfall should also be recorded. This may not always be easy to characterize at large diameter outfalls that drain dozens or even hundreds of acres (unless you have aerial photographs). On the other hand, land use can be easily observed at smaller diameter outfalls, and in some cases, the specific origin can be found (e.g., a roof leader or a parking lot; Figure 25). The specific origin should be recorded in the "notes" portion of Section 1 on the field sheet.

11.5 ORI Section 2 - Outfall Description

This part of the ORI field sheet is where basic outfall characteristics are noted (Figure 26). These include material, and presence of flow at the outfall, as well as the pipe's dimensions (Figure 27). These measurements are used to confirm and supplement existing storm drain maps (if they are available). Many communities only map storm drain outfalls that exceed a given pipe diameter, and may not contain data on the material and condition of the pipe.

Figure 25: The origin of this corrugated plastic pipe was determined to be a roof leader from the house up the hill.

Section 2 of the field sheet also asks if the outfall is submerged in water or obstructed by sediment and the amount of flow, if present. Figure 28 provides some photos that illustrate how to characterize relative submergence, deposition and flow at outfalls. If no flow is observed at the outfall, you can skip the next two sections of the ORI field sheet and continue with Section 5.

Section 2: Outfall Description

LOCATION	MATERIAL	SHAPE		DIMENSIONS (IN.)	SUBMERGED
☐ **Closed Pipe**	☐ RCP ☐ CMP ☐ PVC ☐ HDPE ☐ Steel ☐ Other: _____	☐ Circular ☐ Eliptical ☐ Box ☐ Other: _____	☐ Single ☐ Double ☐ Triple ☐ Other: _____	Diameter/Dimensions: _____	In Water: ☐ No ☐ Partially ☐ Fully With Sediment: ☐ No ☐ Partially ☐ Fully
☐ **Open drainage**	☐ Concrete ☐ Earthen ☐ rip-rap ☐ Other: _____	☐ Trapezoid ☐ Parabolic ☐ Other: _____		Depth: _____ Top Width: _____ Bottom Width: _____	
☐ **In-Stream**	**(applicable when collecting samples)**				
Flow Present?	☐ Yes ☐ No *If No, Skip to Section 5*				
Flow Description (If present)	☐ Trickle ☐ Moderate ☐ Substantial				

Figure 26: Section 2 of the ORI Field Sheet

Figure 27: Measuring Outfall Diameter

Figure 28: Characterizing Submersion and Flow

11.6 ORI Section 3 - Quantitative Characterization for Flowing Outfalls

This section of the ORI records direct measurements of **flowing outfalls**, such as flow, temperature, pH and ammonia (Figure 29). If desired, additional water quality parameters can be added to this section. Chapter 12 discusses the range of water quality parameters that can be used.

Field crews measure the rate of flow using one of two techniques. The first technique simply records the time it takes to fill a container of a known volume, such as a one liter sample bottle. In the second technique,

Section 3: Quantitative Characterization

FIELD DATA FOR FLOWING OUTFALLS				
PARAMETER		RESULT	UNIT	EQUIPMENT
☐Flow #1	Volume		Liter	Bottle
	Time to fill		Sec	
☐Flow #2	Flow depth		In	Tape measure
	Flow width	____' ____"	Ft, In	Tape measure
	Measured length	____' ____"	Ft, In	Tape measure
	Time of travel		S	Stop watch
Temperature			°F	Thermometer
pH			pH Units	Test strip/Probe
Ammonia			mg/L	Test strip

Figure 29: Section 3 of the ORI Field Sheet

the crew measures the velocity of flow, and multiplies it by the estimated cross sectional area of the flow.

To use the flow volume technique, it may be necessary to use a "homemade" container to capture flow, such as a cut out plastic milk container that is marked to show a one liter volume. The shape and flexibility of plastic containers allows crews to capture relatively flat and shallow flow (Figure 30). The flow volume is determined as the volume of flow captured in the container per unit time.

The second technique measures flow rate based on velocity and cross sectional area, and is preferred for larger discharges where containers are too small to effectively capture the flow (Figure 31). The crew measures and marks off a fixed flow length (usually about five feet), crumbles leaves or other light material, and drops them into the discharge (crews can also carry peanuts or ping pong balls to use). The crew then measures the time it takes the marker to travel across the length. The velocity of flow is computed as the length of the flow path (in feet) divided by the travel time (in seconds). Next, the cross-sectional flow area is measured by taking multiple readings of the depth and width of flow. Lastly, cross-sectional area (in square feet) is multiplied by flow velocity (feet/second) to calculate the flow rate (in cubic feet/second).

Crews may also want to measure the quality of the discharge using relatively inexpensive probes and test strips (e.g., water temperature, pH, and ammonia). The choice of which indicator parameters to measure is usually governed by the overall IDDE monitoring framework developed by the community. Some communities have used probes or test strips to measure additional indicators such as conductivity, chlorine, and hardness. Research by Pitt (for this project) suggests that probes by Horiba for pH and conductivity are the most reliable and

Figure 30: Measuring flow (as volume per time)

accurate, and that test strips have limited value.

When probes or test strips are used, measurements should be made from a sample bottle that contains flow captured from the outfall. The exact measurement recorded by the field probe should be recorded in Section 3 of the field sheet. Some interpolation may be required for test strips, but do not interpolate further than the mid-range between two color points.

11.7 ORI Section 4 – Physical Indicators for Flowing Outfalls Only

This section of the ORI field sheet records data about four sensory indicators associated with **flowing outfalls**—odor, color, turbidity and floatables (Figure 32). Sensory indicators can be detected by smell or sight, and require no measurement equipment. Sensory indicators do not always reliably predict illicit discharge, since the senses can be fooled, and may result in a "false negative" (i.e., sensory indicators fail to detect an illicit discharge when one is actually present). Sensory indicators are important, however, in detecting the most severe or obvious discharges. Section 4 of the field sheet asks whether the sensory indicator is present, and if so, what is its severity, on a scale of one to three.

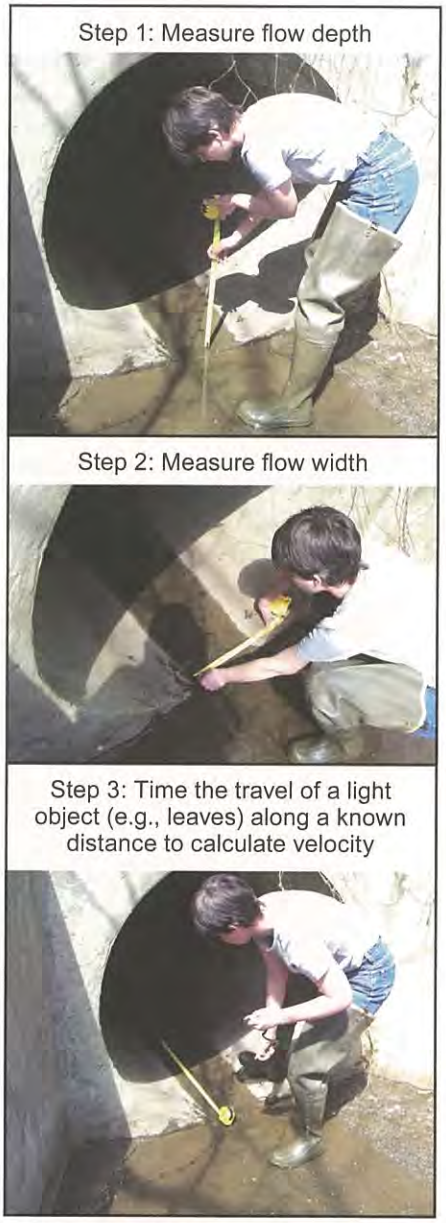


Figure 31: Measuring flow (as velocity times cross-sectional area)

Section 4: Physical Indicators for Flowing Outfalls Only
Are Any Physical Indicators Present in the flow? ☐ Yes ☐ No *(If No, Skip to Section 5)*

INDICATOR	CHECK if Present	DESCRIPTION	RELATIVE SEVERITY INDEX M(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)

Figure 32: Section 4 of the ORI Field Sheet

Odor

Section 4 asks for a description of any odors that emanate from the outfall and an associated severity score. Since noses have different sensitivities, the entire field crew should reach consensus about whether an odor is present and how severe it is. A severity score of one means that the odor is faint or the crew cannot agree on its presence or origin. A score of two indicates a moderate odor within the pipe. A score of three is assigned if the odor is so strong that the crew smells it a considerable distance away from the outfall.

> **TIP**
> Make sure the origin of the odor is the outfall. Sometimes shrubs, trash or carrion, or even the spray paint used to mark the outfall can confuse the noses of field crews.

Color

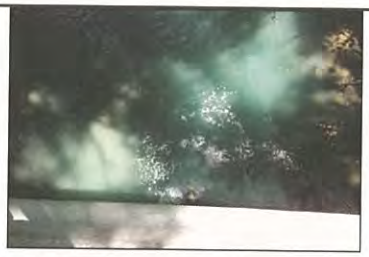
The color of the discharge, which can be clear, slightly tinted, or intense is recorded next. Color can be quantitatively analyzed in the lab, but the ORI only asks for a visual assessment of the discharge color and its intensity. The best way to measure color is to collect the discharge in a clear sample bottle and hold it up to the light (Figure 33). Field crews should also look for downstream plumes of color that appear to be associated with the outfall. Figure 34 illustrates the spectrum of colors that may be encountered during an ORI survey, and offers insight on how to rank the relative intensity or strength of discharge color. Color often helps identify industrial discharges; Appendix K provides guidance on colors often associated with specific industrial operations.

Turbidity

The ORI asks for a visual estimate of the turbidity of the discharge, which is a measure of the cloudiness of the water. Like color, turbidity is best observed in a clear sample bottle, and can be quantitatively measured using field probes. Crews should also look for turbidity in the plunge pool below the outfall, and note any downstream turbidity plumes that appear to be related to the outfall. Field crews can sometimes confuse turbidity with color, which are related but are not the same. Remember, turbidity is a measure of how easily light can penetrate through the sample bottle, whereas color is defined by the tint or intensity of the color observed. Figure 34 provides some examples of how to distinguish turbidity from color, and how to rank its relative severity.

Figure 33: Using a sample bottle to estimate color and turbidity

Color: Brown; Severity: 2
Turbidity Severity: 2



Color: Blue-green; Severity: 3
Turbidity Severity: 2

Highly Turbid Discharge
Color: Brown; Severity: 3
Turbidity Severity: 3

Sewage Discharge
Color: 3
Turbidity: 3

Paint
Color: White; Severity: 3
Turbidity: 3

Industrial Discharge
Color: Green; Severity: 3
Turbidity Severity: 3

Blood
Color: Red; Severity: 3
Turbidity Severity: None

Failing Septic System:
Turbidity Severity: 3

Turbidity in Downstream Plume
Turbidity Severity: 2
(also confirm with sample bottle)

High Turbidity in Pool
Turbidity Severity: 2
(Confirm with sample bottle)

Iron Floc
Color: Reddish Orange; Severity: 3
(Often associated with a natural source)

Slight Turbidity
Turbidity: 1
(Difficult to interpret this observation; May be natural or an illicit discharge)

Construction Site
Discharge
Turbidity Severity: 3

Discharge of Rinse
from Floor Sanding
(Found during wet
weather)
Turbidity Severity: 3

Figure 34: Interpreting Color and Turbidity

Floatables

The last sensory indicator is the presence of any floatable materials in the discharge or the plunge pool below. Sewage, oil sheen, and suds are all examples of floatable indicators; trash and debris are generally not in the context of the ORI. The presence of floatable materials is determined visually, and some guidelines for ranking their severity are provided in Figure 35, and described below.

If you think the floatable is sewage, you should automatically assign it a severity score of three since no other source looks quite like it. Surface oil sheens are ranked based on their thickness and coverage. In some cases, surface sheens may not be related to oil discharges, but instead are created by in-stream processes, such as shown in Figure 36. A thick or swirling sheen associated with a petroleum-like odor may be diagnostic of an oil discharge.

Suds are rated based on their foaminess and staying power. A severity score of three is designated for thick foam that travels many feet before breaking up. Suds that break up quickly may simply reflect water turbulence, and do not necessarily have an illicit origin. Indeed, some streams have naturally occurring foams due to the decay of organic matter. On the other hand, suds that are accompanied by a strong organic or sewage-like odor may indicate a sanitary sewer leak or connection. If the suds have a fragrant odor, they may indicate the presence of laundry water or similar wash waters.

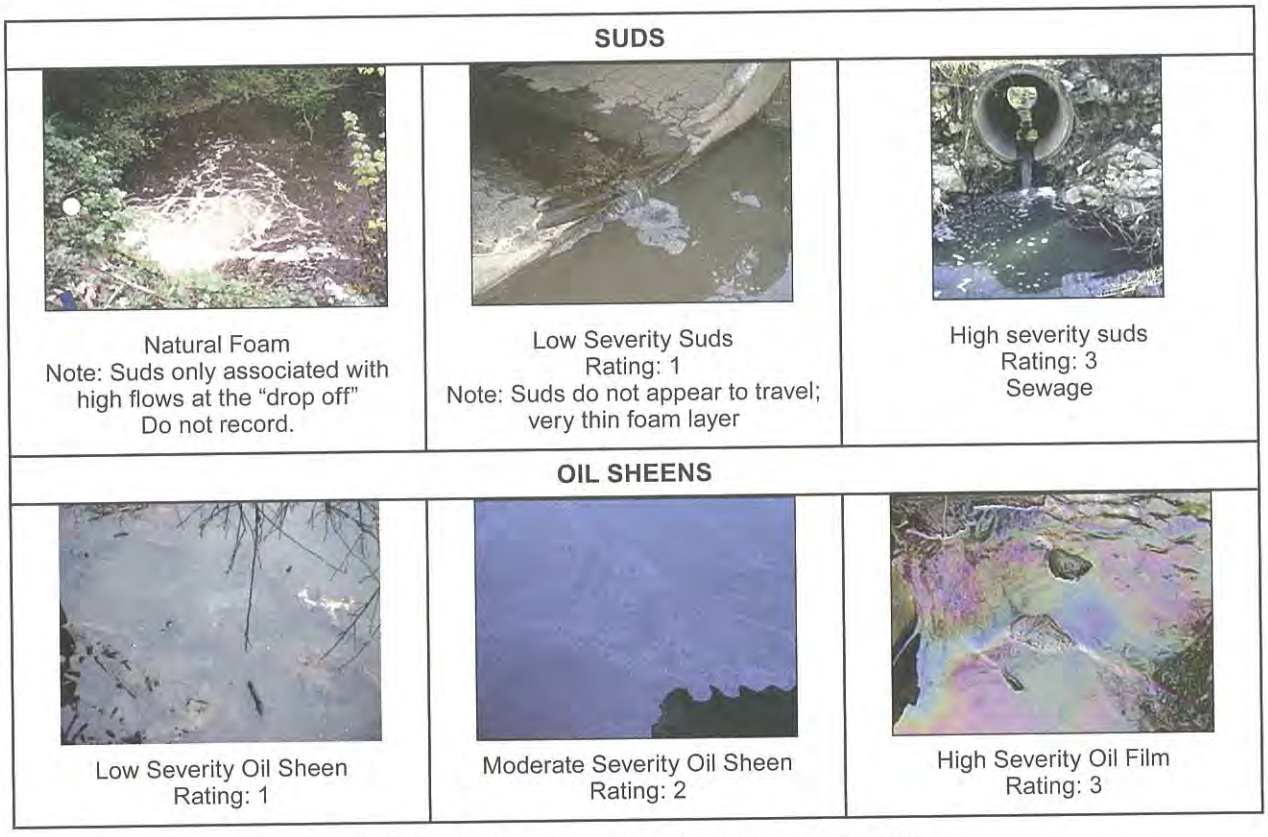


Figure 35: Determining the Severity of Floatables

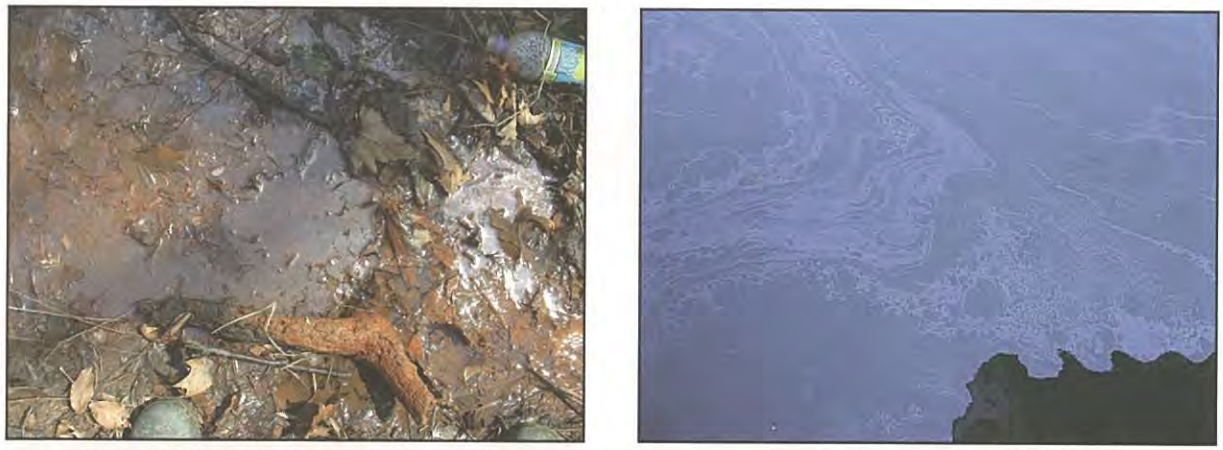


Figure 36: Synthetic versus Natural Sheen (a) Sheen from bacteria such as iron floc forms a sheet-like film that cracks if disturbed (b) Synthetic oil forms a swirling pattern

11.8 ORI Section 5 - Physical Indicators for Both Flowing and Non-Flowing Outfalls

Section 5 of the ORI field sheet examines physical indicators found at both **flowing and non-flowing** outfalls that can reveal the impact of past discharges (Figure 37). Physical indicators include outfall damage, outfall deposits or stains, abnormal vegetation growth, poor pool quality, and benthic growth on pipe surfaces. Common examples of physical indicators are portrayed in Figures 38 and 39. Many of these physical conditions can indicate that an intermittent or transitory discharge has occurred in the past, even if the pipe is not currently flowing. Physical indicators are not ranked according to their severity, because they are often subtle, difficult to interpret and could be caused by other sources. Still, physical indicators can provide strong clues about the discharge history of a storm water outfall, particularly if other discharge indicators accompany them.

Section 5: Physical Indicators for Both Flowing and Non-Flowing Outfalls

Are physical indicators that are not related to flow present? ☐ Yes ☐ No *(If No, Skip to Section 6)*

INDICATOR	CHECK if Present	DESCRIPTION	COMMENTS
Outfall Damage	☐	☐ Spalling, Cracking or Chipping ☐ Peeling Paint ☐ Corrosion	
Deposits/Stains	☐	☐ Oily ☐ Flow Line ☐ Paint ☐ Other:	
Abnormal Vegetation	☐	☐ Excessive ☐ Inhibited	
Poor pool quality	☐	☐ Odors ☐ Colors ☐ Floatables ☐ Oil Sheen ☐ Suds ☐ Excessive Algae ☐ Other:	
Pipe benthic growth	☐	☐ Brown ☐ Orange ☐ Green ☐ Other:	

Figure 37: Section 5 of the ORI Field Sheet

Bacterial growth at this outfall indicates nutrient enrichment and a likely sewage source.

This bright red bacterial growth often indicates high manganese and iron concentrations. Surprisingly, it is not typically associated with illicit discharges.

Sporalitis filamentous bacteria, also known as "sewage fungus" can be used to track down sanitary sewer leaks.

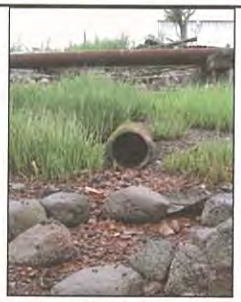
Algal mats on lakes indicate eutrophication. Several sources can cause this problem. Investigate potential illicit sources.

Illicit discharges or excessive nutrient application can lead to extreme algal growth on stream beds.

The drainage to this outfall most likely has a high nutrient concentration. The cause may be an illicit discharge, but may be excessive use of lawn chemicals.

This brownish algae indicates an elevated nutrient level.

Figure 38: Interpreting Benthic and Other Biotic Indicators



Reddish staining on the rocks below this outfall indicate high iron concentrations.

Toilet paper directly below the storm drain outlet.

Watershed Protection??

Trash is not an indicator of illicit discharges, but should be noted.

Staining at the base of the outfall may indicate a persistent, intermittent discharge.

Excessive vegetation may indicate enriched flows associated with sewage.

Brownish stain of unclear origin. May be from degradation of the brick infrastructure.

Cracked rock below the outfall may indicate an intermittent discharge.

Poor pool quality. Consider sampling from the pool to determine origin.

Figure 39: Typical Findings at Both Flowing and Non-Flowing Outfalls

11.9 ORI Sections 6-8 - Initial Outfall Designation and Actions

The last three sections of the ORI field sheet are where the crew designates the illicit discharge severity of the outfall and recommends appropriate management and monitoring actions (Figure 40). A discharge rating is designated as obvious, suspect, potential or unlikely, depending on the number and severity of discharge indicators checked in preceding sections.

It is important to understand that the ORI designation is only an initial determination of discharge potential. A more certain determination as to whether it actually is an illicit discharge is made using a more sophisticated indicator monitoring method. Nevertheless, the ORI outfall

designation gives program managers a better understanding of the distribution and severity of illicit discharge problems within a subwatershed.

Section 7 of the ORI field sheet records whether indicator samples were collected for laboratory analysis, or whether an intermittent flow trap was installed (e.g., an optical brightener trap or caulk dam described in Chapter 13). Field crews should record whether the sample was taken from a pool or directly from the outfall, and the type of intermittent flow trap used, if any. This section can also be used to recommend follow-up sampling, if the crew does not carry sample bottles or traps during the survey.

The last section of the ORI field sheet is used to note any unusual conditions near the outfall such as dumping, pipe failure, bank erosion or maintenance needs. While these maintenance conditions are not directly related to illicit discharge detection, they often are of interest to other agencies and utilities that maintain infrastructure.

11.10 Customizing the ORI for a Community

The ORI method is meant to be adaptable, and should be modified to reflect local conditions and field experience. Some indicators can be dropped, added or modified in the ORI form. This section looks at four of the most common adaptations to the ORI:

- Open Channels
- Submerged/Tidally Influenced Outfalls
- Cold Climates
- Use of Biological Indicators

In each case, it may be desirable to revise the ORI field sheet to collect data reflecting these conditions.

Open Channels

Field crews face special challenges in more rural communities that have extensive open channel drainage. The ditches and channels serve as the primary storm water conveyance system, and may lack storm drain and sewer pipes. The open channel network is often very long with only a few obvious outfalls that are located far apart. While the network can have illicit discharges from septic systems, they can typically only be detected in the ORI if a straight pipe is found. Some adaptations for open channel systems are suggested in Table 33.

Section 6: Overall Outfall Characterization

☐ Unlikely ☐ Potential (presence of two or more indicators) ☐ Suspect (one or more indicators with a severity of 3) ☐ Obvious

Section 7: Data Collection

1. Sample for the lab?	☐ Yes	☐ No		
2. If yes, collected from:	☐ Flow	☐ Pool		
3. Intermittent flow trap set?	☐ Yes	☐ No	If Yes, type: ☐ OBM	☐ Caulk dam

Section 8: Any Non-Illicit Discharge Concerns (e.g., trash or needed infrastructure repairs)?

Figure 40: Sections 6-8 of the ORI Field Sheet

Submerged/Tidally Influenced Outfalls

The ORI can be problematic in coastal communities where outfalls are located along the waterfront and may be submerged at high tide. The ORI methods need to be significantly changed to address these constraints. Often, outfalls are initially located from offshore using canoes or boats, and then traced landward to the first manhole that is not tidally influenced. Field crews then access the storm drain pipe at the manhole and measure whatever indicators they can observe in the confined and dimly lit space. Table 33 recommends strategies to sample outfalls in the challenging environment of coastal communities.

Winter and Ice

Ice can be used as a discharge indicator in northern regions when ice forms in streams and pipes during the winter months (Figure 41). Because ice lasts for many weeks, and most illicit discharges are warm, astute field crews can interpret outfall history from ice melting patterns along pipes and streams. For example, exaggerated melting at a frozen or flowing outfall may indicate warm water from sewage or industrial discharge. Be careful, because groundwater is warm enough to cause some melting at below freezing temperatures. Also, ice acts like an intermittent flow trap, and literally freezes these discharges. Crews should also look for these traps to find any discolored ice within the pipe or below the outfall.

A final winter indicator is "rime ice," which forms when steam freezes. This beautiful ice formation is actually a good indicator of sewage or other relatively hot discharge that causes steam to form (Figure 41).

Biological Indicators

The diversity and pollution tolerance of various species of aquatic life are widely used as an indicator of overall stream health, and has sometimes been used to detect illicit discharges. One notable example is the presence of the red-eared slider turtle, which is used in Galveston, Texas to find sewage discharges, as they have a propensity for the nutrient rich waters associated with sewage (Figure 42).

Table 33: Special Considerations for Open Channels/Submerged Outfalls

OPEN CHANNELS	
Challenge	**Suggested Modification**
Too many miles of channel to walk	Stop walking at a given channel size or drainage area
Difficulty marking them	Mark on concrete or adjacent to earth channel
Interpreting physical indicators	For open channels with mild physical indicators, progress up the system to investigate further.
SUBMERGED/TIDALLY INFLUENCED OUTFALLS	
Challenge	**Suggested Modification**
Access for ORI – Tidal Influence	Access during low tide
Access for ORI – Always submerged	Access by boat or by shore walking
Interpreting physical indicators	For outfalls with mild physical indicators, also inspect from the nearest manhole that is not influenced by tides
Sampling (if necessary)	Sample "up pipe"

Figure 41: Cold climate indicators of illicit discharges

Figure 42: One biological indicator is this red-eared slider turtle

11.11 Interpreting ORI Data

The ORI generates a wealth of information that can provide managers with valuable insights about their illicit discharge problems, if the data are managed and analyzed effectively. The ORI can quickly define whether problems are clustered in a particular area or spread across the community. This section presents a series of methods to compile, organize and interpret ORI data, including:

1. Basic Data Management and Quality Control
2. Outfall Classification
3. Simple Suspect Outfall Counts
4. Mapping ORI Data
5. Subwatershed and Reach Screening
6. Characterizing IDDE Problems at the Community Level

The level of detail for each analysis method should be calibrated to local resources, program goals, and the actual discharge problems discovered in the stream corridor. In general, the most common conditions and problems will shape your initial monitoring strategy, which prioritizes the subwatersheds or reaches that will be targeted for more intensive investigations.

Program managers should analyze ORI data well before every stream mile is walked in the community, and use initial results to modify field methods. For example, if initial results reveal widespread potential problems, program managers may want to add more indicator monitoring to the ORI to track down individual discharge sources (see Chapter 12). Alternatively, if the same kind of discharge problem is repeatedly found, it may be wise to investigate whether there is a common source or activity generating it (e.g., high turbidity observed at many flowing outfalls as a result of equipment washing at active construction sites).

Basic Data Management and Quality Control

The ORI produces an enormous amount of raw data to characterize outfall conditions. It is not uncommon to compile dozens of individual ORI forms in a single subwatershed. The challenge is to devise a system to organize, process, and translate this data into simpler outputs and formats that can guide illicit discharge elimination efforts. The system starts with effective quality control procedures in the field.

Field sheets should be managed using either a three-ring binder or a clipboard. A small field binder offers the ability to quickly flip back and forth among the outfall forms. Authorization letters, emergency contact lists, and extra forms can also be tucked inside.

At the end of each day, field crews should regroup at a predetermined location to compare notes. The crew leader should confirm that all survey reaches and outfalls of interest have been surveyed, discuss initial findings, and deal with any logistical problems. This is also a good time to check whether field crews are measuring and recording outfall data in the same way, and are consistent in what they are (or are not) recording. Crew leaders should also use this time to review field forms for accuracy and thoroughness. Illegible handwriting should be neatened and details added to notes and any sketches. The crew leader should also organize the forms together into a single master binder or folder for future analysis.

Once crews return from the field, data should be entered into a spreadsheet or database. A Microsoft Access database is provided with this Manual as part of Appendix D (Figure 43), and is supplied on a compact disc with each hard copy. It can also be downloaded with Appendix D from http://www.stormwatercenter.net. Information stored in this database can easily be imported into a GIS for mapping purposes. The GIS can generate its own database table that allows the user to create subwatershed maps showing outfall characteristics and problem areas.

Once data entry is complete, be sure to check the quality of the data. This can be done quickly by randomly spot-checking 10% of the entered data. For example, if 50 field sheets were completed, check five of the spreadsheet or database entries. When transferring data into GIS, quality control maps that display labeled problem outfalls should be created. Each survey crew is responsible for reviewing the accuracy of these maps.

Outfall Classification

A simple outfall designation system has been developed to summarize the discharge potential for individual ORI field sheets. Table 34 presents the four outfall designations that can be made.

Table 34: Outfall Designation System Using ORI Data

Designation	Description
1. Obvious Discharge	Outfalls where there is an illicit discharge that doesn't even require sample collection for confirmation
2. Suspect Discharge	Flowing outfalls with high severity on one or more physical indicators
3. Potential Discharge	Flowing or non-flowing outfalls with presence of two or more physical indicators
4. Unlikely Discharge	Non-flowing outfalls with no physical indicators of an illicit discharge

Simple Suspect Outfall Counts

The first priority is to count the frequency of each outfall designation in the subwatershed or the community as a whole. This simple screening analysis counts the number of problem outfalls per stream mile (i.e., the sum of outfalls designated as having potential, suspected or obvious illicit discharge potential). The density of problem outfalls per stream mile is an important metric to target and screen subwatersheds.

Based on problem outfall counts, program managers may discover that a particular monitoring strategy may not apply to the community. For example, if few problem outfalls are found, an extensive follow-up monitoring program may not be needed, so that program resources can be shifted to pollution hotlines to report and control transitory discharges such as illegal dumping. The key point of this method is to avoid getting lost in the raw data, but look instead to find patterns that can shape a cost-effective IDDE program.

Mapping ORI Data

Maps are an excellent way to portray outfall data. If a GIS system is linked to the ORI database, maps that show the spatial distribution of problem outfalls, locations of dumping, and overall reach conditions can be easily generated. Moreover, GIS provides flexibility that allows for rapid updates to maps as new data are collected and compiled. The sophistication and detail of maps will depend on the initial findings, program goals, available software, and GIS capability.

Subwatershed maps are also an effective and important communication and education tool to engage stakeholders (e.g., public officials, businesses and community residents), as they can visually depict reach quality and the location of problem outfalls. The key point to remember is that maps are tools for understanding data. Try to map with a purpose in mind. A large number of cluttered maps may only confuse, while a smaller number with select data may stimulate ideas for the follow-up monitoring strategy.

Subwatershed and Survey Reach Screening

Problem outfall metrics are particularly valuable to screen or rank priority subwatersheds or survey reaches. The basic approach is simple: select the outfall metrics that are most important to IDDE program goals, and then see how individual subwatersheds or reaches rank in the process. This screening process can help determine which subwatersheds will be priorities for initial follow-up monitoring efforts. When feasible, the screening process should incorporate non-ORI data, such as existing dry weather water quality data, citizen complaints, permitted facilities, and habitat or biological stream indicators.

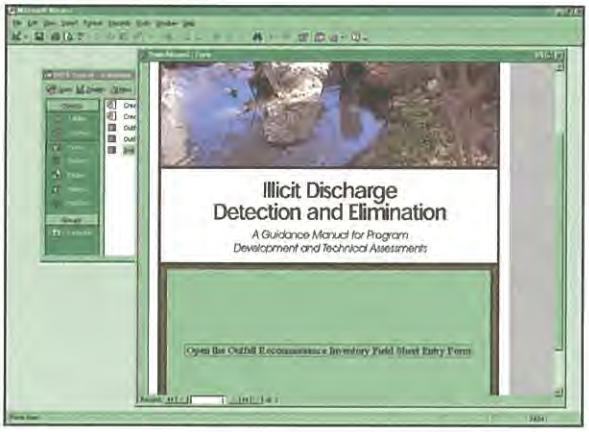


Figure 43: Sample screen from ORI Microsoft Access database

An example of how outfall metrics can screen subwatersheds is provided in Table 35. In this hypothetical example, four metrics were used to screen three subwatersheds within a community: number of suspect discharges, subwatershed population as a percent of the total community, number of industrial discharge permits, and number of outfalls per stream mile. Given these screening criteria, subwatershed C was selected for the next phase of detailed investigation.

Characterizing the IDDE Problem at the Community Level

ORI data should be used to continuously revisit and revise the IDDE program as more is learned about the nature and distribution of illicit discharge problems in the community. For example, ORI discharge designation should be compared against illicit discharge potential (IDP) predictions made during the original desktop analysis (Chapter 5) to refine discharge screening factors, and formulate new monitoring strategies.

In general, community illicit discharge problem can be characterized as minimal, clustered, or severe (Table 36). In the minimal scenario, very few and scattered problems exist; in the clustered scenario, problems are located in isolated subwatersheds; and in the severe scenario, problems are widespread.

Table 35: An Example of ORI Data Being Used to Compare Across Subwatersheds

	# of suspect discharges	Population as % of total community	# of industrial discharge permits	# of outfalls per stream/ conveyance mile
Subwatershed A	2	30	4	6
Subwatershed B	1	10	0	3
Subwatershed C	8	60	2	12

Table 36: Using Stream and ORI Data to Categorize IDDE Problems

Extent	ORI Support Data
Minimal	• Less than 10% of total outfalls are flowing • Less than 20% of total outfalls with obvious, suspect or potential designation
Clustered	• Two thirds of the flowing outfalls are located within one third of the subwatersheds • More than 20% of the communities subwatersheds have greater than 20% of outfalls with obvious, suspect or potential designation
Severe	• More than 10% of total outfalls are flowing • More than 50% of total outfalls with obvious, suspect or potential designation • More than 20% of total outfalls with obvious or suspect designation

11.12 Budgeting and Scoping the ORI

Many different factors come into play when budgeting and scoping an ORI survey: equipment needs, crew size and the stream miles that must be covered. This section presents some simple rules of thumb for ORI budgeting.

Equipment costs for the ORI are relatively minor, with basic equipment to outfit one team of three people totaling about $800 (Table 37). This cost includes one-time expenses to acquire waders, a digital camera and a GPS unit, as well as disposable supplies.

The majority of the budget for an ORI is for staffing the desktop analysis, field crews and data analysis. Field crews can consist of two or three members, and cover about two to three miles of stream (or open channel) per day. Three staff-days should be allocated for pre- and post-field work for each day spent in the field.

Table 38 presents example costs for two hypothetical communities that conduct the ORI. Community A has 10 miles of open channel to investigate, while Community B has 20 miles. In addition, Community A has fewer staff resources available and therefore uses two-person field crews, while Community B uses three-person field crews. Total costs are presented as annual costs, assuming that each community is able to conduct the ORI for all miles in one year.

Table 37: Typical Field Equipment Costs for the ORI

Item	Cost
100 Latex Disposable Gloves	$25
5 Wide Mouth Sample Bottles (1 Liter)	$20
Large Cooler	$25
3 Pairs of Waders	$150
Digital Camera	$200
20 Cans of Spray Paint	$50
Test Kits or Probes	$100-$500
1 GPS Unit	$150
1 Measuring Tape	$10
1 First Aid Kit	$30
Flashlights, Batteries, Labeling tape, Clipboards	$25
Total	**$785-$1185**

Table 38: Example ORI Costs		
Item	**Community A**	**Community B**
Field Equipment[1]	$700	$785
Staff Field Time[2]	$2,000	$6,000
Staff Office Time[3]	$3,000	$6,000
Total	**$5,700**	**$12,785**

[1] From Table 44
[2] Assumes $25/hour salary (2 person teams in Community A and three- person teams in Community B) and two miles of stream per day.
[3] Assumes three staff days for each day in field.

Appendix E – Analytical Procedures for Outfall Monitoring

Ammonia

Ammonia is a good indicator of sewage, since its concentration is much higher there than in groundwater or tap water. High ammonia concentrations may also indicate liquid wastes from some industrial sites. Ammonia is relatively simple and safe to analyze. Some challenges include the tendency for ammonia to volatilize (i.e., turn into a gas and become non-conservative) and its potential generation from non-human sources, such as pets or wildlife.

Boron

Boron is an element present in the compound borax, which is often found in detergent and soap formulations. Consequently, boron is a good potential indicator for both laundry wash water and sewage. Preliminary research from Alabama supports this contention, particularly when it is combined with other detergent indicators, such as surfactants (Pitt, IDDE Project Support Material). Boron may not be a useful indicator everywhere in the country since it may be found at elevated levels in groundwater in some regions and is a common ingredient in water softeners products. Program mangers should collect data on boron concentrations in local tap water and groundwater sources to confirm whether it will be an effective indicator of illicit discharges.

Chlorine

Chlorine is used throughout the country to disinfect tap water, except where private wells provide the water supply. Chlorine concentrations in tap water tend to be significantly higher than most other discharge types. Unfortunately, chlorine is extremely volatile, and even moderate levels of organic materials can cause chlorine levels to drop below detection levels. Because chlorine is non-conservative, it is not a reliable indicator, although if very high chlorine levels are measured, it is a strong indication of a water line break, swimming pool discharge, or industrial discharge from a chlorine bleaching process.

Color

Color is a numeric computation of the color observed in a water quality sample, as measured in cobalt-platinum units (APHA, 1998). Both industrial liquid wastes and sewage tend to have elevated color values. Unfortunately, some "clean" flow types can also have high color values. Field testing by Pitt (IDDE Project Support Material) found high color values associated for all contaminated flows, but also many uncontaminated flows, which yielded numerous false positives. Overall, color may be a good first screen for problem outfalls, but needs to be supplemented by other indicator parameters.

Conductivity

Conductivity, or specific conductance, is a measure of how easily electricity can flow through a water sample. Conductivity is often strongly correlated with the total amount of dissolved material in water, known as Total Dissolved Solids. The utility of conductivity as an indicator depends on whether concentrations are elevated in "natural" or clean waters. In particular, conductivity is a poor indicator of illicit discharge in estuarine waters or in northern regions where deicing salts are used (both have high conductivity readings).

Field testing in Alabama suggests that conductivity has limited value to detect sewage or wash water (Pitt, IDDE Project Support Material). Conductivity has some

value in detecting industrial discharges that can exhibit extremely high conductivity readings. Conductivity is extremely easy to measure with field probes, so it has the potential to be a useful supplemental indicator in subwatersheds that are dominated by industrial land uses.

Detergents

Most illicit discharges have elevated concentration of detergents. Sewage and washwater discharges contain detergents used to clean clothes or dishes, whereas liquid wastes contain detergents from industrial or commercial cleansers. The nearly universal presence of detergents in illicit discharges, combined with their absence in natural waters or tap water, makes them an excellent indicator. Research has revealed three indicator parameters that measure the level of detergent or its components-- surfactants, fluorescence, and surface tension (Pitt, IDDE Project Support Material). Surfactants have been the most widely applied and transferable of the three indicators. Fluorescence and surface tension show promise, but only limited field testing has been performed on these more experimental parameters. Methods and laboratory protocols for each of the three detergent indicator parameters are reviewed in Appendix F2.

E. coli, Enterococci and Total Coliform

Each of these bacteria is found at very high concentrations in sewage compared to other flow types, and is a good indicator of sewage or septage discharges, unless pet or wildlife sources exist in the subwatershed. Overall, bacteria are good supplemental indicators and can be used to find "problem" streams or outfalls that exceed public health standards. Relatively simple analytical methods are now available to test for bacteria indicators, although they still suffer from two monitoring constraints. The first is the relatively long analysis time (18-24 hours) to get results, and the second is that the waste produced by the tests may be classified as a biohazard and require special disposal techniques.

Fluorescence

Laundry detergents are highly fluorescent because optical brighteners are added to the formula to produce "brighter whites." Optical brighteners are the reason that white clothes appear to have a bluish color when placed under a fluorescent light. Fluorescence is a very sensitive indicator of the presence of detergents in discharges, using a fluorometer to measure fluorescence at specific wavelengths of light. Since no chemicals are needed for testing, fluorometers have minimal safety and waste disposal concerns.

Some technical concerns do limit the utility of fluorescence as an indicator of illicit discharges. The concerns include the presence of fluorescence in non-illicit flow types such as irrigation water, the considerable variation of fluorescence between different detergent brands, and the lack of a readily standard or benchmark concentration for optical brighteners. For example, Pitt (IDDE Project Support Material) measured fluorescence in mg/L of Tide™ brand detergent, and found the degree of fluorescence varied regionally, temporally, and between specific detergent formulations.

Given these current limitations, fluorescence is best combined with other detergent indicators such as surfactants. Appendix F3 should be consulted for more detailed information on analytical methods and experimental field testing using fluorescence as an indicator parameter.

Fluoride

Fluoride is added to drinking water supplies in most communities to improve dental health, and normally found at a concentration of two parts per million in tapwater. Consequently, fluoride is an excellent conservative indicator of tap water discharges or leaks from water supply pipes that end up in the storm drain. Fluoride is obviously not a good indicator in communities that do not fluoridate drinking water, or where individual wells provide drinking water. One key constraint is that the reagent used in the recommended analytical method for fluoride is considered a hazardous waste, and must be disposed of properly.

Hardness

Hardness measures the positive ions dissolved in water and primarily include magnesium and calcium in natural waters, but are sometimes influenced by other metals. Field testing by Pitt (IDDE Project Support Material) suggests that hardness has limited value as an indicator parameter, except when values are extremely high or low (which may signal the presence of some liquid wastes). Hardness may be applicable in communities where hardness levels are elevated in groundwater due to karst or limestone terrain. In these regions, hardness can help distinguish natural groundwater flows present in outfalls from tap water and other flow types.

pH

Most discharge flow types are neutral, having a pH value around 7, although groundwater concentrations can be somewhat variable. pH is a reasonably good indicator for liquid wastes from industries, which can have very high or low pH (ranging from 3 to 12). The pH of residential wash water tends to be rather basic (pH of 8 or 9). The pH of a discharge is very simple to monitor in the field with low cost test strips or probes. Although pH data is often not conclusive by itself, it can identify problem outfalls that merit follow-up investigations using more effective indicators.

Potassium

Potassium is found at relatively high concentrations in sewage, and extremely high concentrations in many industrial process waters. Consequently, potassium can act as a good first screen for industrial wastes, and can also be used in combination with ammonia to distinguish wash waters from sanitary wastes. (See Chapter 12). Simple field probes can detect potassium at relatively high concentrations (5 mg/L), whereas more complex colorimetric tests are needed to detect potassium concentrations lower than 5 mg/L.

Surface Tension

Surfactants remove dirt particles by reducing the surface tension of the bubbles formed in laundry water when it is agitated. Reduced surface tension makes dirt particles less likely to settle on a solid surface (e.g., clothes or dishes) and become suspended instead on the water's surface. The visible manifestation of reduced surface tension is the formation of foam or bubbles on the water surface. Pitt (IDDE Project Support Material) tested a very simple procedure to measure surface tension that quantifies the formation of foam and bubbles in sample bottles. Initial laboratory tests suggest that surface tension is a good indicator of surfactants, but only when they are present at relatively high concentrations. Section F3 provides a more detailed description of the surface tension measurement procedure.

Surfactants

Surfactants are the active ingredient in most commercial detergents, and are typically measured as Methyl Blue Active Substances (or MBAS). They are a synthetic replacement for soap, which builds up deposits on clothing over time. Since surfactants are not found in nature, but are always present in detergents, they are excellent indicators of sewage and wash waters. The presence of surfactants in cleansers, emulsifiers and lubricants also makes them an excellent indicator of industrial or commercial liquid wastes. In fact, research by Pitt (IDDE Project Support Material) found that detergents were an excellent indicator of "contaminated" discharges in Alabama (i.e., discharges that were not tap water or groundwater). Several analytical methods are available to monitor surfactants. Unfortunately, the reagents used involve toluene, chloroform, or benzene, each of which is considered hazardous waste with a potential human health risk. The most common analysis method uses chloroform as a reagent, and is recommended because it is relatively safer when compared to other reagents.

Turbidity

Turbidity is a quantitative measure of cloudiness in water, and is normally measured with a simple field probe. While turbidity itself cannot always distinguish between contaminated flow types, it is a potentially useful screening indicator to determine if the discharge is contaminated (i.e., not composed of tap water or groundwater).

Research Indicators

In recent years, researchers have explored a series of other indicators to identify illicit discharges, including fecal steroids (such as coprostanol), caffeine, specific fragrances associated with detergents and stable isotopes of oxygen. Each of these research indicators is profiled in Pitt (IDDE Project Support Material) and summarized below in Table F1. Most research indicators require sophisticated equipment and specific expertise that limit their utility as a general indicator, given the high sampling cost and long turn-around times needed. To date, field tests of research indicators have yielded mixed results, and they are currently thought to be more appropriate for special research projects than for routine outfall testing. While they are not discussed further in this manual, future research and testing may improve their utility as indicators of illicit discharges.

Appendix F – IDDE Program Enforcement Example Letter

MMM DD, YYYY

John Doe
Environmental Manager
XYZ Inc.
1000 Example Street
Lexington, NE 68###

NOTICE OF VIOLATION – ILLICIT DISCHARGE/CONNECTION

Dear Mr. Doe,

This letter is a follow-up to an inspection of your property (Address) by City of Lexington staff on MMM DD, YYYY. It was determined during the inspection that pipes from your facility are connected to the storm sewer within the City Limits and illicit discharges from your facility has previously been observed to also discharge into the storm sewer. The City has no record of approval for such a connection. The construction, connection, use, maintenance or continued existence of any illegal connection to the city's separate storm sewer system is prohibited.

XYZ, Inc. has 15 days to remove any connection and discharge into the stormwater system. If the connection is not removed within this time, the property owner shall be liable to criminal prosecution, and shall be subject to a criminal penalty of up to one hundred dollars ($100.00) per violation per day.

You may appeal this violation determination of the city. The notice of appeal shall be in writing and shall be delivered to the city clerk within thirty (10) days from the date of the notice of violation. Hearing on the appeal before the City Administrator shall take place within fifteen (15) days from the date of receipt of the notice of appeal. The pendency of an appeal shall not relieve the responsible person from complying with the requirements of the notice of violation, unless the City Administrator otherwise consents in writing.

If you fail to remediate or restore within the established deadline, the work will be done by a designated governmental agency or a contractor and the expense thereof shall be charged to the violator and may be assessed against the real estate or collected by civil action. Representatives of the city may enter upon the subject private property and are authorized to take any and all measures necessary to abate the violation and/or restore the property. It shall be unlawful for any person, owner, agent or person in possession of any premises to refuse to allow the city's designees or agents to enter upon the premises for the purposes set forth in this section.

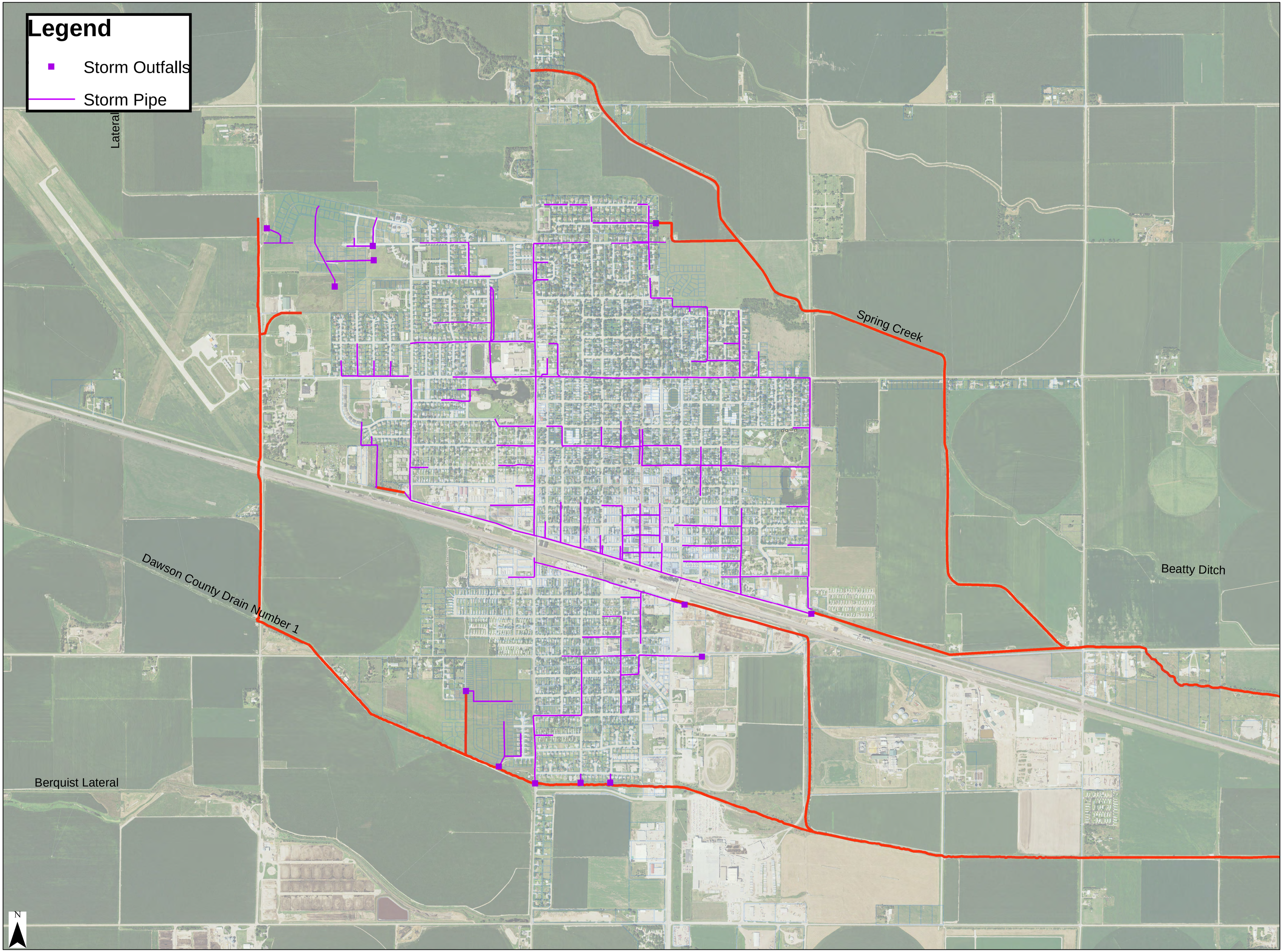
It is the sole responsibility of XYZ, Inc. to ensure that it complies with all environmental regulations both at the state and local levels. XYZ, Inc must comply with all appropriate stormwater ordinances and standards. If you have questions regarding this matter, please call me at 308-324-3811

Sincerely,

Bill Brecks
Lexington Development Services Director

Pc: Lexington City Administrator
Reuel Anderson, NDEE
File

Appendix G – Lexington MS4 Outfall Map (Current)


Legend
Storm Outfalls
Storm Pipe
Lateral
Spring Creek
Dawson County Drain Number 1
Beatty Ditch
Berquist Lateral
N