LAKE COUNTY
Illicit Discharge Detection and Elimination
(IDDE)
Guidance Manual

By

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1. INTRODUCTION

PURPOSE OF MANUAL

This manual was prepared for the primary purpose of improving the water resources of Lake County, and as recommended guidance for meeting Illicit Discharge Detection and Elimination (IDDE) requirements of IEPA General NPDES permit No. ILR40.

The manual provides an overview of the objectives, procedures, and components of an IDDE program for the identification and removal of illicit discharges (pollutants) to storm sewer systems and surface water bodies. The manual is intended for use by both the public official interested in developing and managing a stormwater outfall-screening program and the field staff responsible for conducting actual outfall screening. Step-by-step instructions for identifying storm sewers suspected of containing pollutants, suggestions for actions to be taken to determine the sources of identified pollutants, and steps for correcting identified problems are provided.

The stormwater outfall-screening program presented in this manual represents only one of the 6 NPDES components of a comprehensive stormwater management program (SWMP). A regulated Municipal Separate Storm Sewer Systems (MS4s) community implementing an outfall-screening program of this type should also be implementing the other important aspects of a NPDES comprehensive stormwater management program. This includes raising the awareness and education of the general public regarding stormwater management and pollution.

This document is a revision of the Lake Michigan Watershed Stormwater Outfall Screening Program Training Program (April 1994 by SMC), and incorporates material from the Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments (October 2004 by the Center for Watershed Protection and Robert Pitt, University of Alabama). Additional resources for implementing NPDES requirements can be found in APPENDIX A (web links to IEPA and USEPA regulations and fact sheets).

ORGANIZATION OF MANUAL

The manual is organized into three sections with accompanying appendices. It is intended to provide the user with the background and understanding of the problems associated with illicit discharges to storm sewers, a discussion of the methodology and procedures of developing a stormwater outfall-screening program, and the step-by-step procedures to conduct outfall screening.

Section 1 introduces the purpose and organization of the manual. *Section 2* of the further defines the problem of pollutant discharges to storm sewer systems and associated impacts on surface water quality. Examples of common sources of inappropriate discharges are also presented. Lastly, a solution to the problem-a stormwater outfall screening program-is identified and discussed.

Section 3 of the manual presents and discusses the components of an outfall screening program-from estimating the effort and scheduling associated with a program, to conducting outfall screening activities, analyzing outfall-screening data, investigating identified problems, correcting identified problems, and evaluating the program.

Appendices of the manual provide critical supporting data and tools required to design and implement an outfall-screening program. Several of the appendices are intended to be photo copied and used in conducting the outfall screening activities of the program.

2. DEFINITION OF PROBLEM AND PROBLEM SOLUTION

This section of the manual discusses the problem of illicit discharges to storm sewer systems and surface water bodies and provides examples of illicit discharges. A stormwater outfall-screening program is then presented and discussed as a solution to the problem.

ILLICIT DISCHARGES

An illicit discharge is defined by the USEPA ***as any discharge to a municipal separate storm sewer that is not composed entirely of stormwater (with exceptions)*** (Code of Federal Regulations, Title 40, Part 122.26 ([b] [2]). Because these discharges occur in dry weather when storm sewer flows typically should not exist, they are referred to as ***dry-weather discharges.***

Illicit discharges enter storm sewer systems in two ways:

1) through direct piping connections to the storm sewer system, these connections are referred to as *illicit*, or *direct*, *connections* and

2) through subtle connections, or *indirect discharges*, such as dumping or spillage of materials (for example, the dumping of waste motor oil into storm sewer drains).

Illicit, or direct, connections are more likely to result in continuous pollutant discharges than are subtle connections, which often produce limited, intermittent discharges of pollutants.

PROBLEM BACKGROUND

Illicit discharges contribute considerable pollutant loadings to receiving waters. USEPA cites several studies that indicate the magnitude of the problem associated with inappropriate discharges to storm sewer systems (USEPA. 1993.Investigation of Inappropriate Pollutant Entries into Storm Drainage Systems: A User's Guide. Cincinnati, Ohio.).

Toronto, Canada (1984): dry-weather discharges were found to be the dominant source of many pollutants.

Washtenaw County, Michigan (1984 to 1986): 160 businesses were dye-tested for evidence of illicit connections; 61, or 38 percent, were found to have improper storm drain connections.

Sacramento, California (1987): slightly less than half the water discharged from the Village's stormwater drainage system was not directly attributable to precipitation and was, therefore, associated with a non-stormwater flow.

Huron River Pollution Abatement Program, Michigan (1987): 1,067 commercial, industrial, and tax exempt business and buildings were dye-tested for evidence of illicit connects; 154, or 14 percent, of the businesses and buildings tested were found to have improper storm sewer connections (commercial car washes and other automobile-related operations were the major portion of the illicit connections in this study and the Washtenaw County study).

Inner Grays Harbor, Washington (1987): 32 percent of the 90 urban stormwater outfalls surveyed revealed dry-weather flows; 21 percent of the outfalls surveyed were described as suspect with regard to pollutant levels.

The results of these and other studies indicate that inappropriate or non-stormwater discharges contribute significant pollutant loadings to surface water bodies and should be corrected.

The history of illicit discharge regulations is long and convoluted, reflecting an ongoing debate as to whether they should be classified as a point or nonpoint source of pollution. The Clean Water Act Amendments of 1987 contained the first provision to specifically regulate discharges from storm drainage systems. Section 402 (p)(3)(B) provides that "permits for such discharges:

i. May be issued on a system or jurisdiction-wide basis
ii. Shall include a requirement to effectively prohibit non-storm water discharges into the storm sewers; and
iii. Shall require controls to reduce the discharge of pollutants to the maximum extent practical including management practices, control techniques and system design and engineering methods, and such provisions as the Administrator or the State determines appropriate for the control of such pollutants."

Since that time, NPDES permits have gradually been applied to a greater range of communities. In 1990, EPA issued a rule, known as Phase I to implement section 402 (p) of the Clean Water Act through the NPDES permit system. The USEPA effort expanded in December 1999 when the Phase II rule was issued.

SOURCES OF ILLICIT DISCHARGES

Illicit discharges result from direct, illicit connections to the storm sewer system and indirect sources such as dumping and spills. Table 1 summarizes some of the potential residential and commercial/industrial sources of direct and indirect inappropriate discharges.

Table 1 shows that *direct, or illicit, connections to storm sewer systems most likely originate from commercial/industrial facilities. Thus, the focus of this program is on the identification of illicit discharges from commercial/industrial facilities.*

PROBLEM SOLUTION

Because inappropriate discharges exist regardless of whether or not a stormwater event (for example, rain or melting snow) is occurring, they can be detected during dry-weather periods. Inspecting stormwater outfalls during dry-weather conditions will reveal whether non-stormwater flows exist. If non-stormwater flows are observed, they can be screened and tested to determine whether pollutants are present. The results of the procedures presented in this manual are intended to serve as indicators of pollution, rather than to provide specific quantitative results. If the presence of pollutants is indicated, the detective work of identifying the source of the discharge can begin. Once the source is identified, it can then be corrected.

Section 3 of the manual describes how to implement a dry-weather stormwater outfall-screening program to identify and correct inappropriate discharges to the storm sewer system. It also includes step-by-step procedures for conducting the outfall screening activities of the program.

Table 1

POTENTIAL SOURCES OF ILLICIT DISCHARGES TO STORM SEWERS

Potential Sources	Storm Sewer Entry		Flow Characteristics	
	Direct	Indirect	Continuous	Intermittent
Residential Sources				
Sanitary Wastewater	√	X	√	X
Septic Tank Effluent	-	√	√	X
Household Chemicals	X	√	-	√
Laundry Wastewater	√	-	-	√
Excess Landscaping Watering	-	√	-	√
Leaking Potable Water Pipes	-	√	√	-
Commercial Sources				
Gasoline Filling Stations	√	x	-	√
Vehicle Maint./Repair Facilities	√	x	-	√
Laundry Wastewater	√	-	√	x
Construction Site Dewatering	-	√	√	x
Sanitary Wastewater	√	x	√	-
Industrial Sources				
Leaking Tanks and Pipes	x	√	√	x
Misc. Process Waters	√	x	√	x

√ Most likely condition.
X May occur.
- Not very likely.

Source: *Adapted From: USEPA. January 1993. Investigation of Inappropriate Pollutant Entries Into Storm Drainage Systems: A User's Guide. Cincinnati, Ohio.*

3. STORMWATER OUTFALL SCREENING PROGRAM

PROGRAM ELEMENTS

This section of the manual presents and discusses the elements required to develop and implement a dry-weather stormwater outfall-screening program. An outfall-screening program consists of three principal components: 1) program planning, 2) outfall screening, and 3) follow-up investigation and program evaluation (see Figure 1).

1. ***Program Planning*** involves the office work, planning, and organization required to conduct the subsequent outfall screening and follow-up investigative activities of the program. Program planning includes definition of the regulatory authority to remove illicit discharges, identification of the outfalls and receiving waters in the municipality, identification of the staffing and equipment needed to conduct the outfall screening, and scheduling of the outfall screening activities.

2. ***Outfall Screening*** consists of the actual outfall inspection and field-testing conducted to determine whether dry-weather flows are present at outfalls selected for inspection and whether pollutants are present in any observed dry-weather flows from the outfalls.

3. ***Follow-Up Investigation and Program Evaluation*** are the steps necessary to determine the sources of any identified pollutant flows and eliminate them. The follow-up investigation and program evaluation component includes reviewing and assessing outfall-screening results, conducting detailed storm sewer investigations to identify pollutant sources, exercising the appropriate legal means to achieve enforcement of the program objective (*removal of pollutants at the source)*, and evaluating the program to determine whether subsequent screening activities are necessary.

PROGRAM PLANNING

The program planning component addresses the following issues (see Figure 2 for a flow chart of the program-planning component):

- Regulatory authority,
- Identification of receiving waters and outfalls,
- Staffing,
- Equipment acquisition, and
- Scheduling

Figure 1: PROGRAM ELEMENTS

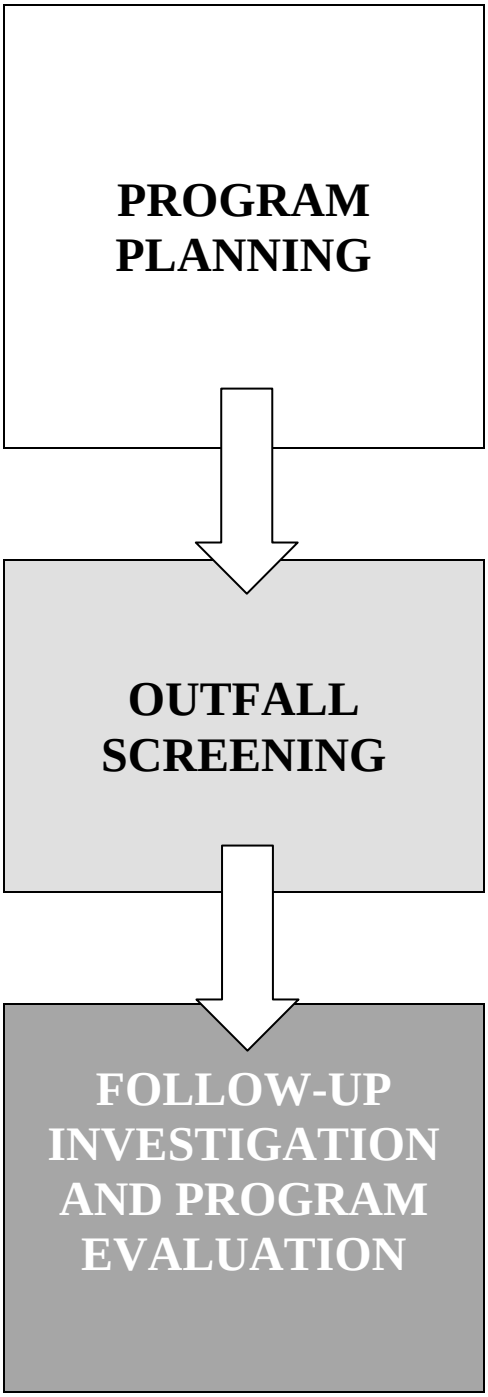
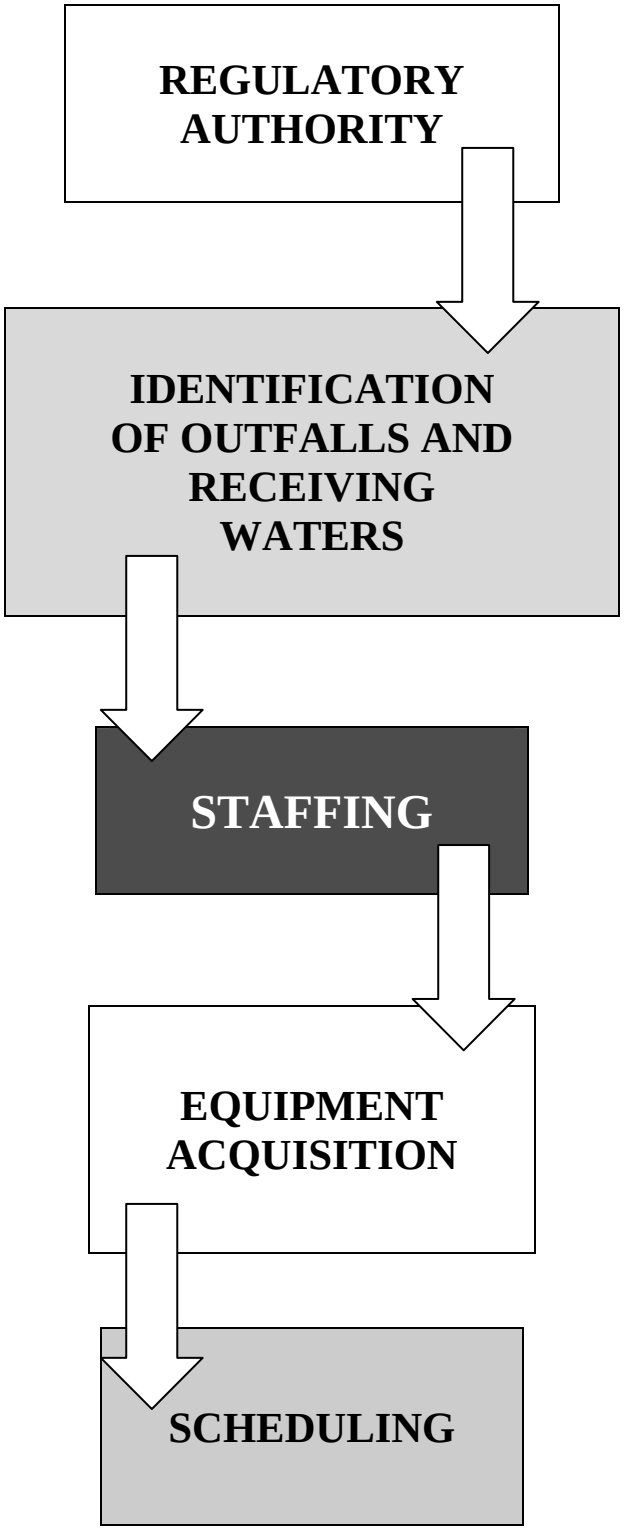


Figure 2: PROGRAM PLANNING COMPONENTS



TO OUTFALL SCREENING

The program-planning component is primarily office work related to assembling the necessary information and equipment for efficiently conducting outfall-screening activities.

REGULATORY AUTHORITY

Effective implementation of an outfall-screening program requires adequate legal authority to remove illicit discharges and prohibit future illicit discharges. This regulatory authority is typically achieved through adoption of a comprehensive stormwater management ordinance or a specific water quality or pollution control ordinance. (Reference Appendix B)

In the absence of the local legal authority to control inappropriate discharges, IEPA has regulatory authority to control pollutant discharges and can take the necessary steps to correct or remove an inappropriate discharge.

IDENTIFICATION OF OUTFALLS AND RECEIVING WATERS

Understanding the nature of illicit discharges in urban watersheds is essential to find, fix and prevent them. While "official" definitions for outfalls and receiving waters exist, their translation to field conditions is a mater of interpretation, and complicates the practicalities of developing and implementing effective IDDE programs.

An Outfall is defined at 40 CFR 122.26(B)(9) and means a point source as defined by 40 CFR 122.2 at the point where a municipal separate storm sewer discharges to waters of the United States and does not include open conveyances connecting two municipal storm sewers, or pipes, tunnels or other conveyances which connect segments of the same stream or other waters of the United States and are used to convey waters of the Unites States.

For the purposes of this manual a receiving water is a natural or man-made system into which stormwater or wastewater is discharged. The ultimate receiving waters for stormwater in Lake County are the Fox River, Des Plaines River, North Branch of the Chicago River, and Lake Michigan. Some storm sewer outfalls in the watershed discharge directly to these receiving waters, whereas others discharge to tributary rivers, creeks, streams, ravines, and wetlands.

SMC as a Qualifying Local Program encourages program managers to initiate a program to address outfalls that pose the greatest threats to water quality in their community first. Then as their program develops, to identify and eliminate potential pollution sources. To assist in this process a mapping protocol was developed (reference Appendix C).

In 1994 SMC supported the definition of *major* outfalls, which are defined as:

- outfalls 36 inches or greater in diameter serving residential land uses, or
- other single conveyance serving greater than 50 residential areas, and
- outfalls greater than 12 inches in diameter associated with sewers from commercial/industrial land uses, or
- other single conveyance serving 2 acres or greater of commercial/industrial land uses.

Many Lake County communities began their outfall inventories as part of the first NPDES permitting cycle (2003-2008). With this as a starting point, MS4's should plan to supplement this available information as their program develops. Using available storm system or drainage maps, all major residential and commercial/industrial outfalls should be identified. Then, using land use or zoning maps, all additional outfalls 12 inches in diameter or larger and all outfalls that drain 2 acres or more of predominately commercial or industrial land should also be identified. This review of available drainage maps would be supplemented by knowledge of the MS4's land uses, drainage configuration, and potential pollutant sources to identify additional outfalls that would possibly warrant screening. A community's detailed sewer maps and field staff knowledge would be used to locate actual outfalls in the field during screening activities. It should be noted that the definition of major outfall used by USEPA should be used as a guideline and that smaller outfalls can, and should, be included in the screening program, if possible.

If a municipality has an outfall numbering system in place, the existing system should be used. If not, it is important to develop an outfall numbering system and use the system throughout the outfall-screening program. A suggested system is to use the drainage basin name, municipality name, and outfall number.

STAFFING

Labor for an outfall-screening program is required for program administration and staff effort for conducting the outfall screening and any follow-up investigations. A two-member field crew is required for the outfall screening and follow-up portions of the program. At a minimum, one screening crew must be identified. With a two-member crew, six to eight outfalls can be expected to be screened in a day.

Table 2 presents a summary of the estimated labor to conduct outfall screening for a municipality with 20 outfalls. The estimates in the table should serve as indicators of the level of effort required to implement a program. The estimates do not include effort for follow-up investigation and removal of identified inappropriate discharges, which will be community-specific.

Table 2

STORMWATER OUTFALL SCREENING PROGRAM LABOR ESTIMATE

Estimated Labor Hours				
Task	DPW or Superintendent	Crew Member	Crew Member	Total Hours
Training Manual Review	4	2	2	8
Field Training (1)	4	4	4	12
Program Planning				
Assess Regulatory Authority	4			4
Identify Outfalls and Receiving Waters	8	8		16
Identify Staff	2			2
Order/Maintain Equipment	4	4		8
Monitor Rainfall	2			2
Outfall Screening				
Plan Screening	4			4
Screen 20 Outfalls (2)	8	36	36	80
Follow-Up Evaluation				
Summarize Results	8			4
Investigate/Remove Sources (3)				
Evaluate Program	4			4
Total	52	54	42	144

1) Participation in 1/2 –day SMC training.
2) Assumes 20 outfalls at six outfalls per day and time for verification of observed dry-weather flows.
3) Cannot be estimated prior to completing screening. However, a conservative estimate would be to assume that 30 percent of screened outfalls will require follow-up investigation at 4 to 8 hours per outfall.

EQUIPMENT NEEDS

General field equipment and specialized outfall screening equipment are required for IDDE programs. Collecting and managing inventory screening data will be driven by available technology. GPS and GIS are preferred methods for collecting and managing data. Paper recording is also a reliable recording system, and will be the method outlined in this manual. Regardless of the recording methods, the objective is to gather reliable data to identify and eliminate pollution sources. Therefore, this manual focuses on collecting the relevant data for the primary objective.

Basic field equipment needed for screening activities include waders, a measuring tape, watch, camera, GPS unit, and surgical gloves. A complete list of recommend equipment and supplies is found in Appendix D. GPS units and digital cameras are usually the most expensive equipment items; however, some local agencies may already have them for other applications. Water-resistant, downloadable GPS units with adequate range 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.

SCHEDULING

Scheduling outfall screening is dependent on staff availability and weather. Outfall screening should generally take place during the late summer or fall months, ideally in August, September, or October, although other summer months may be acceptable, depending on weather conditions. This time period is generally warm, which improves field efficiency as well as reliability and consistency of field-testing. This time period is also more likely to have extended dry periods with little or no precipitation, which is required for the inspection activities. Many municipalities schedule outfall screening activities in conjunction with planned maintenance and inspection activities.

The major scheduling constraint for outfall screening is the requirement of a preceding dry-weather period. In order to ensure that samples collected are representative of dry-weather flows, a period of 72 hours of dry weather should occur prior to conducting outfall-screening activities.

A period of 72 hours is selected to allow local detention facilities to drain and local groundwater flows to recede after precipitation events. However, some judgment may be exercised in evaluating the 72-hour period to sampling. For example, if very light rain or drizzle occurred and no runoff was experienced, it is likely that dry-weather conditions would exist and outfall inspection could be conducted.

The final aspect of scheduling is to develop an outfall inspection schedule to visit each identified outfall in the municipality. A general outfall-screening schedule should be prepared, based on outfall locations and an inspection rate of six to eight outfalls per day. This schedule must be updated on a daily basis once outfall screening has begun to make adjustments for unloadable outfalls and required second inspections of outfalls with dry-weather flows (outfall-screening procedures are discussed later in the manual)

OUTFALL SCREENING

The outfall-screening component of the outfall-screening program is where the presence or absence of a dry-weather flow is determined and data of the characteristics of observed flows are obtained. With this information, sources of illicit discharges can be identified and corrected.

Outfall screening consists of the following three major tasks:

- Daily setup,
- Outfall inspection, and
- Daily closeout

DAILY SETUP

The outfall-screening schedule should be reviewed to determine which outfalls have been screened and which outfalls are scheduled for screening. The scheduling should show which outfalls require initial inspections and secondary inspections. In this step, an attempt should be made to visualize the outfall locations and anticipate any potential problems that could affect the day's screening activities. Of particular concern in daily setup is whether any safety issues will be associated with, the day's screening activities. For example, will traffic need to be controlled or will access to the outfall be difficult (safety considerations are discussed in greater detail later in the manual).

Before leaving on daily outfall inspections, field crews must ensure that all necessary equipment is available, operable, and calibrated (as appropriate).

OUTFALL INSPECTION

Outfall Observation

Upon arriving at an outfall, the field crew should inspect the outfall by approaching the outfall on foot to a proximity that will allow visual observations to be made.

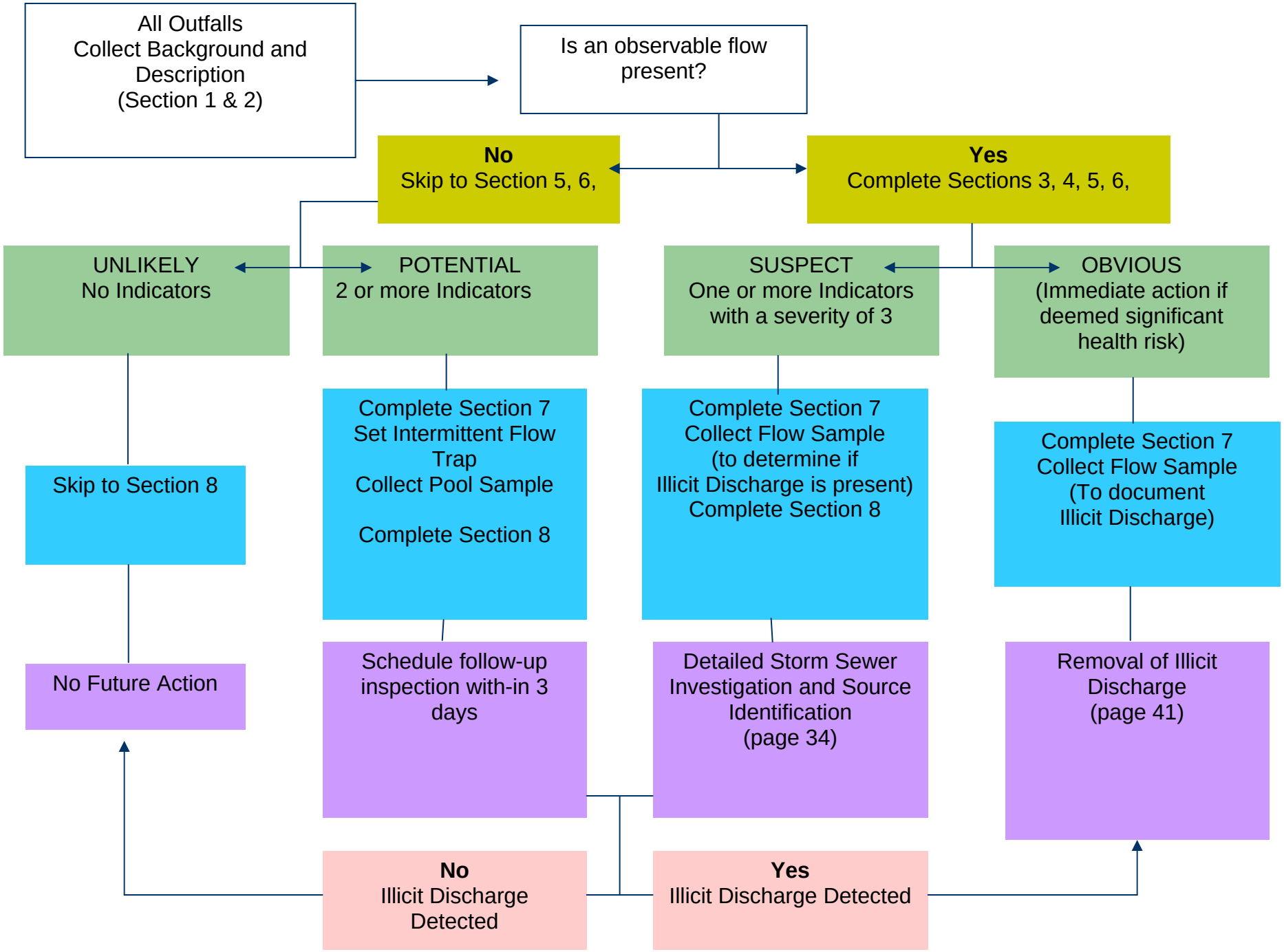
Outfalls should be screened to determine which one of the three following conditions applies:

(1) The outfall is dry or damp with no observed flow,

(2) Flowing discharges are observed from the outfall, or

(3) The outfall is partially or completely submerged with no observed flow or is inaccessible.

Figure 3 presents the outfall inspection process


All Outfalls
Collect Background and Description
(Section 1 & 2)
Is an observable flow present?
No
Skip to Section 5, 6,
Yes
Complete Sections 3, 4, 5, 6,
UNLIKELY
No Indicators
POTENTIAL
2 or more Indicators
SUSPECT
One or more Indicators with a severity of 3
OBVIOUS
(Immediate action if deemed significant health risk)
Skip to Section 8
Complete Section 7
Set Intermittent Flow Trap
Collect Pool Sample
Complete Section 8
Complete Section 7
Collect Flow Sample
(to determine if Illicit Discharge is present)
Complete Section 8
Complete Section 7
Collect Flow Sample
(To document Illicit Discharge)
No Future Action
Schedule follow-up inspection with-in 3 days
Detailed Storm Sewer Investigation and Source Identification
(page 34)
Removal of Illicit Discharge
(page 41)
No
Illicit Discharge Detected
Yes
Illicit Discharge Detected

Scenario 1: No Observed Flow. Under Scenario 1 conditions, the field crew should photograph the outfall and complete sections 1,2, 5,6,7,8 of the ***Stormwater Outfall Screening Data Form***, a copy of which is provided in Appendix E. (Instructions for filling out the outfall screening data form are presented later in the manual).

Scenario 2: Observed Flow. If flow is observed from the outfall, the field crew should complete all sections of the ***Stormwater Outfall Screening Data Form,*** and obtain a grab sample to conduct the required field test and/or for laboratory analyses. Field analyses should be conducted when screening results can be characterized as *potential.* The intent is to gather additional information to determine if an illicit discharge is present. Samples are to be collected for laboratory analysis when the discharge present is characterized as *suspect* or *obvious*. Laboratory results will be used to identify potential sources, and to document the event for future removal and/or enforcement actions.

If dry-weather flow is observed, the outfall location must be noted and a second inspection must be conducted with 24 hours of the initial inspection, with a minimum of 4 hours between inspections. For example, if a dry-weather flow is observed in an outfall in the morning, it can be reinspected at the end of the same day or in the morning of the following day.

Scenario 3: Submerged or Inaccessible Outfall. If standing water is present in an outfall or if it is inaccessible, then Section 1 of the outfall screening data from should be completed, with appropriate comments being written in the "Remarks" section of the data form. Locating an upstream sampling point may be required if any of the following conditions exist at an outfall:

- The outfall discharge is submerged or partially submerged due to backwater conditions,
- Site access and safety considerations prevent sample collection,
- The outfall is from a facility providing water quality treatment (for example, detention basin outlet), or
- Other special considerations.

Locating an upstream sampling location will typically involve using available storm sewer maps or atlases to track the storm sewer system. Manholes, catch basins, or culvert crossings can be used for upstream sampling locations. However, collection of a sample may be more difficult for these locations. The field crew should make reasonable efforts to locate upstream sampling points that are accessible and exhibit flow. Field crews should attempt to inspect the next one or two upstream manholes as sampling points. If inaccessible, the problem should be resolved in the office with appropriate supervisory personnel.

Safety should be the primary consideration while inspecting upstream sampling locations. Safety concerns related to removing manhole lids or catch basin covers include 1) traffic hazards; 2) personal injuries to the back, hands, and fingers; and 3) possible explosive conditions. Safety considerations for outfall screening discussed later in this manual should be carefully followed. In

general, the rule *if in doubt, "**don't**"* should be followed. Latex gloves should always be worn while collecting and handling samples. Wading for samples should be avoided in locations where bottom sediments are easily disturbed or depths are unknown. If traffic is heavy and removal of a manhole lids would cause traffic obstructions, the manhole should not be selected for sampling. Likewise, if strong gasoline or solvent odors are noticed from a manhole, the manhole should not be selected for sampling. **IN NO CASE SHOULD FIELD CREW MEMBERS WHO ARE UNTRAINED AND/OR UNEQUIPPED FOR CONFINED SPACE ENTRY ATTEMPT TO ENTER CONFINED SPACES.** Confined space entry would include climbing into, or inserting one's head into pipes or manholes. In general, a horizontal or vertical plane should be established at the end of an outfall pipe or level with a manhole surface. This plane should not be crossed by field crews. An extended sample collection device should be used in these situations.

Data Recording

All outfall inspections and outfall analyses must be documented in the **Stormwater Outfall Screening Data Form (a blank data form is provided in Appendix E).** All completed forms must be dated, legible, and should contain accurate documentation of each outfall inspection. *A separate data form must be completed for each outfall.* Non-smearing pens should be used to complete the forms. All language should be objective, factual, and free of inappropriate terminology. Once completed, these data forms will become accountable documents and will be maintained as part of the municipality's files.

In addition to standard information, the data form should be used to record other information that is noted at the time the outfall inspection is conducted. For example, observations of dead or dying plants, fish kills, algal blooms (excessive algae growth), construction activities, and other activities that might provide information regarding the potential for illicit connections or inappropriate discharges should be recorded on the form.

The steps for filling out the outfall screening data form are as follows.

The top portion of page 1 of the data form should be completed upon arrival at the stormsewer outfall.

Section 1- Background Data

Subwatershed: The identified receiving water from the stormwater outfall inventory to be entered here.

Outfall ID: The outfall identification number from the stormwater outfall inventory to be entered here.

Date: To avoid confusion, dates are be written in the following manner: DAY MONTH YEAR. For example, 10 MARCH 2007.

Time: Military time (24-hour clock) to be used (for example, 8:30 a.m. would be written as 0830; likewise, 1:30 p.m. would be written as 1330).

Investigators: The names of the field sampling crew is to be recorded.

Temperature : A concise description of the weather conditions at the time of the screening is to be recorded (for example, Clear, 75○ F).

Previous 48 Hours Precipitation: The total amount of precipitation during the 48 hours preceding the inspection is to be noted (for example, None-72 Hours or 0"=4 days). If the total precipitation is not known, it is appropriate to enter a qualitative assessment if the precipitation was minor. For example, *Drizzle-36 Hours* if appropriate. If the precipitation amount was significant, actual precipitation totals should be obtained from a local rain gage, if available.

Outfall Location: A concise description of the outfall location is to be provided giving latitude and longitude. The description should be sufficient to relocate outfall for future inspections.

Photo ID: Photographs are to be taken with a camera that superimposes a date and time on the film. The date and time should correspond to the date and time recorded on the data form.

Land Use: Check all that apply, noting which land uses predominate.

Notes: A description of the actual sampling location is to be recorded (for example, at end of outfall pipe). If the outfall is submerged or is inaccessible for sampling, an upstream sampling location may be required. A description of any upstream sampling location should be recorded here.

Section 2: Outfall Description

Type of Outfall (Closed Pipe or Open Drainage):
First check if the outfall inventoried is either from a Closed Pipe or Open Drainage system, or In-Stream (if collecting samples). Then complete table row to describe outfall characteristics.

Dry-Weather Flow Observed (Yes/No): A *Yes* or *No* should be entered here to indicate the presence of absence of a dry-weather flow. If the outfall is submerged or inaccessible, "See Remarks" should be entered and an explanation should be provided in the "Remarks" section.

If an upstream sampling location is located, then a new data form should be completed describing the actual location sampled. If no upstream site is located in the field, an alternative site should be located in the office by reviewing storm sewer and drainage maps or atlases.

Flow Present:
If *No* is entered in the "Flow Present" block, then skip to Section 4.

If *Yes* is entered in the Dry-Weather Flow Observed block, then the remainder of the outfall screening data form should be filled out. *This will require that field observations and analyses be*

conducted on two separate occasions during a 24-hour period with a minimum of four hours between outfall inspections.

Section 3: Quantitative Characterization

A grab sample should be collected from the middle, both vertically and horizontally, of the dry-weather flow discharge. The grab sample should be collected in a 1-liter polyethylene container. Samples can be collected by manually dipping a sample container into the flow. The sample container should be rinsed twice with the discharge water prior to collection of sample for analysis.

Grab samples may also be collected using a bucket and lien or extended sample collection rod by standing on the top of an outfall or manhole. Care should be taken to ensure that a representative sample is obtained from the dry-weather discharge.

Flow: A description of the dry-weather flow should be provided. (More detailed flow data are also required but should be obtained after visual and olfactory observations have been made; these data should be recorded on the data form. Detailed procedures for estimating flow rates are presented in Appendix F.)

Section 4 Physical Indicators for flowing Outfalls Only

Odor: The presence of an odor is to be assessed by fanning the hand toward the nose over a wide-mouth container of the sample, keeping the sample about 6 to 8 inches from the face. Be careful not be distracted by odors in the air. If present a description of the odor should be provided.

Color: The presence of color in the discharge is to be assessed by filling a clean glass sample container with a portion of the grab sample and comparing the sample with a color chart if color is present. If a color chart is used, the number corresponding to the color matching the sample is to be entered in this blank. Color should not be assessed by looking into the discharge.

Turbidity: Turbidity is a measure of the clarity of water. Turbidity may be caused by many factors, including suspended matter such as clay, silt, or finely divided organic and inorganic matter. Turbidity is a measure of the optical properties that cause light to be scattered and not transmitted through a sample. The presence of turbidity is to be assessed by comparing the sample to clean glass sample container with colorless distilled water. Turbidity should be described as;

- Clear,
- Cloudy (translucent), or
- Opaque.

Floatables: The presence of floating scum, foam, oil sheen, or other materials on the surface of the discharge are to be noted. A concise description of any floatables present should be provided. Trash originating from areas adjacent to the outfall should not be included in this observation; and description of floatables should be attributable to discharges from the outfall.

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

No flow during the time of the inspection, should not rule out the potential of illicit discharges. Corroding or stained pipes, dead or absence of vegetation, are potential indicators of illicit discharges from direct or indirect (i.e. dumping) sources.

Section 6 Overall Outfall Characterization

Check the appropriate characterization based on the indicators present in Sections 4 and 5.

- *Unlikely*- No flow present or physical indicators present. No future action needed.
- *Potential*- Two or more indicators present. Follow-up inspection low priority.
- *Suspect*- One or more indicators with severity of 3 present. Follow-up inspection high priority.
- *Obvious*- When obvious discharges are encountered, filed crews should STOP the 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 (ONLY IF THIS CAN BE DONE SAFELY). All three kinds of evidence are extremely helpful to support subsequent enforcement.

Section 7 Data Collection

<u>Test Kit Chemical Analyses</u>

Test kit chemical analyses must be conducted for the following parameters for any dry-weather discharge observed and characterized as *Potential*:

- pH,
- Chlorine,
- Copper,
- Phenols,
- Detergents, and
- Ammonia

These tests will aid in determining the sources of inappropriate discharges, which is discussed late in the manual.

Several companies manufacture test kits for these parameters. As discussed earlier, test kits by CHEMetrics, Inc., were chosen for example purposes for this program. Detailed, step-by-step instructions for using the test kits are provided in Appendix G-Stormwater Outfall Inspection Standard Operating Procedures. These instructions, which are provided by the manufacturer, must be followed when using the equipment.

Use of the test kits will typically require filling a small (25ml) cup with water from the grab-sample container. The following procedures should be followed for all test kit analyses:

1. Rinse the appropriate sample cup twice with distilled water.

2. Swirl the grab sample to ensure that the sample is well mixed.

3. Rinse the sample cup twice with water from the grab Sample.

4. Fill the sample cup to the 25 ml mark, or as required by the instructions for the test kits. Hold the sample cup at eye level to ensure that measurements are accurate.

5. Conduct the test kit analyses following the manufacturer's instructions.

6. Dispose of the sample as follows:

    - If no chemical or reagents have been added to the sample, the water can be poured on the ground.

    - If any chemical or reagent is added to the sample, the water should be poured into a container marked "Liquid Waste" for proper disposal to a sanitary sewer system at the end of the day.

7. Rinse the sample cup three times with tap water and dry with a paper towel.

Before leaving any field inspection site, the area should be checked to ensure that all equipment has been cleaned, collected, and stored. No trash or litter should be left at any site. Proper disposal of test waste items is as follows:

Item	**Field Disposal**	**Final Disposal**
Grab Sample (Uncontaminated)	On Site	-----
Grab Sample (Contamintated by Contact with Test Kit Ampoule)	Liquid Waste Container	Sanitary Sewer
Test Kit Ampoule	Used Ampoule container	Dispose of Container As a Hazardous Waste
Paper Towels/ Latex Gloves	Trash Bags	Municipal Garbage

At the completion of each outfall inspection, the field crews are responsible for ensuring that an outfall screening data form has been completely and correctly filled out and that all data and remarks are legible. ***It is important to check that value for all chemical parameters have been entered on the outfall screening data form before leaving an outfall inspection site***. The outfall screening data forms have blanks for the values detected with each test kit; each of the test kits produces results in milligrams per liter (mg/1), or parts per million (ppm); the units ppm are provided on the form.

Incorrect entries should be struck out with a single line; correct values or descriptions should be written above or near the struck-out entries. In no case should a new data entry form be used to correct an incorrect entry.

Following sample analyses, field crews should rinse all sampling equipment with tap water. Test kit sample cups and other containers used for chemical parameters analyses should be thoroughly rinsed with a wash bottle containing distilled water and shaken dry before being put away.

Section 8 Any Non-Illicit Discharge Concerns
Any problems or unusual features are to be entered here. If the outfall appears to be potentially impacted by inappropriate discharges, this can be recorded here. This section is to be completed even if no flow is observed.

Daily Closeout

In the office, copies of completed data forms should be filed. In addition, the outfall screening scheduling and completion form should be updated and the next screening day's activities should be planned.

Any problems locating outfalls should be discussed with appropriate supervisory personnel so that alternate sampling locations can be identified.

SAFETY CONSIDERATIONS

Traffic

All traffic control measures are to be in accordance with the requirements of the Manual on Uniform Traffic Control Devices.

In general, vehicles should not be parked, nor should sampling occur, where field crews will obstruct traffic. If no alternative exists and traffic volume is light, traffic cones and car emergency flashers should be used. A suburban residential street with limited traffic would be an example. These suburban residential streets will typically have a posted speed limit of 25 MPH or less. Field crews should check with the appropriate municipal staff for specific traffic control procedures. General traffic control guidelines are presented as follow in the absence of community-specific guidelines.

Field crews should generally be allowed to work on streets only during the hours of 9 a.m. to 4 p.m. except in emergency situations.

All field crews should be required to wear steel-toe boots, reflective vests, and hard hats if they are inside or in the immediate vicinity of streets during outfall screening activities. Along streets with moderate traffic volume, one of the field crewmembers should serve as a flagger using a slow or stop/go paddle to divert traffic around the sampling point. A third crewmember may be required in these situations.

The general procedure in these cases should be as follows:

1. Stop car 10 to 15 feet behind sampling point and set car flashers.

2. Set up traffic cones to divert traffic around work area.

3. Station flagger 20 to 30 yards behind work area to alert oncoming traffic.

4. Collect sample and record observations as quickly as possible; do not conduct test kit analyses in traffic.

5. Replace manhole lid or catch basin covers; collect traffic cones.

6. Drive to a nearby side street or parking area and conduct test kit analyses.

Along major thoroughfares with high traffic volumes and posted speed limits greater than 45 MPH, field crews should defer sampling until appropriate traffic control assistance can be scheduled.

Access Hazards

Access to each outfall should be assessed for potential hazards. Examples of hazards are steep slopes, dense brush, excessive heights and deep water. Field crews must decide on a case-by-case basis whether an outfall can be safely accessed for inspection

Test Kit Analysis Safety

1. Test kit analyses involve handling samples that may be toxic or unsanitary and the use of potentially harmful chemicals. The following rules should be followed at all times when using test kits:

2. Latex gloves should be worn AT ALL TIMES when handling samples or conducting test kit analyses.

3. Copies of material safety data sheets (MSDs) should be maintained with all test kits (MSDSs for chemicals used with the test kits are provided with the test kit standard operating procedures in Appendix F). Field crews should be familiar with instructions provided in the MSDSs.

4. Never look directly into a sample container or place a sample container near the nose.

5. Always conduct test kit analyses in a well-ventilated area. The inside of a closed vehicle should not be used.

6. Wash hands thoroughly with soap and water at every opportunity (for example, at lunch breaks and at the end of the day).

7. Steel-toe boots should be worn at all times.

The following other hazards may be encountered during outfall screening:

Hazard	Prevention
Bodily Harm From Manholes	Do Not Use Fingers for Handling Manhole Covers
Slips and Falls	Proper Foot Gear and Use of Rope If Warranted
Heat and Dehydration	Adequate Water Intake; Avoid Excessive Exertion on Hot Days
Sunburn	Sunscreen and Appropriate Clothing
Poisonous Plants/Animals	Identify and Avoid
Stray Dogs	Avoid; Use Animal Repellent if Unavoidable
Deep Water	Use Flotation Device if Working Near Deep Water
Ticks	Check Entire Body at End of Each Day of Screening

A first aid kit should be provided for each sampling crew to treat minor injuries. Medical help should be obtained for major injuries as soon as possible. All injuries, minor and major, should be reported to appropriate persons.

A snakebite kit should also be provided for each crew. Crewmembers bitten by snakes should be rushed to the nearest medical facility for treatment.

The names and telephone numbers of emergency-personnel contacts should be included with first aid supplies. Field crews should provide specific medical information that would be helpful to medical personnel or would impact their ability to conduct screening activities (for example, allergies to bee stings and back injuries) to supervisory personnel.

Confined Space Entry

Confined space entry for this program would include climbing into or inserting one's head into a pipe, manhole, or catch basin. In general, the vertical plane defining an outfall pipe or the horizontal plane defining a manhole should not be crossed by field crews. **IN NO CASE SHOULD FIELD CREW MEMBERS WHO ARE UNTRAINED AND/OR UNEQUIPPED FOR CONFINED SPACE ENTRY ATTEMPT TO ENTER CONFINED SPACES.** Confined space entry should be conducted only by trained personnel with appropriate rescue and monitoring equipment. Minimum safety equipment might include hard hats and protective clothing; a winch and safety line connected to a person on a harness; a personal gas monitor that measures oxygen deficiency, toxic gases, and explosive gases; and two-way radios.

ACCESS TO PRIVATE PROPERTY

In some cases, it may be necessary for field crews to enter or cross private property to inspect outfalls. A form letter should be prepared that should include a short description of the project, the purpose of the access to the property, and the name of a project contact person with a telephone number. An attempt should be made to contact each homeowner for permission, as necessary. Field crews should have identification indicating that they are municipal employees. If permission to access property is denied, the homeowner's name, address, and telephone number should be obtained (if possible). A public official should then contact the homeowner at a later date.

If a homeowner is not present, the property should be visited. If entry is not possible, the form letter should be left with a handwritten request to facilitate entry for the following day (for example, *Please make sure dog is on a leash*).

Field crews should avoid confrontational situations with citizens and should attempt to answer questions concisely and without being alarmistic. Field crews should be coached on appropriate responses to questions from citizens.

QUALITY ASSURANCE GUIDELINES

Outfall screening data will be used to determine the need for additional monitoring and remediation activities (for example, removal of illicit connections or enforcement of provisions preventing illegal dumping). Therefore, it is imperative that all outfall screening activities strictly adhere to quality management protocols.

Quality control (QC) is a system of specific, routine activities and procedures (for example, equipment calibration, duplicate analyses, and maintenance) that are designed and implemented to ensure the quality of the outfall screening data.

Quality assurance (QA) is the system under which specific QC activities are incorporated. QA includes quality planning, assessments of QC performance (for example, through audits), and standard procedures for reporting and improving QC.

Complete quality assurance guidelines for this program are provided in Appendix H; a summary of the guidelines is presented as follows:

Training

All field crews should thoroughly read and understand the objectives of the Outfall Screening subsection of this manual and the test kit standard operating procedures. Field personnel should have completed a standard training session. A senior field investigator should accompany new field personnel on at least two outfall inspections to learn the use of the outfall screen data forms and the use of sampling equipment and test kits. As a training exercise, new field personnel should independently conduct outfall screening activities until two outfall screening data forms are accurate and consistent with the senior field investigator's forms.

Documentation

All outfall screening and grab sampling activities must be documented and traceable through field records to the field crew members who collected the samples and to the specific pieces of sampling equipment (where appropriate) used to collect and analyze the samples. All data forms must have the initials and signatures of the field crew members who completed the forms. The signatures on the data form will imply that all information entered is accurate and complete to the best of the field investigators knowledge.

Weekly calibration and maintenance activities should also be documented and filed. In addition, instrument such as pH meters should be assigned an identification number; this number should be noted on the outfall screening data forms.

Sampling Precision and Representativeness

Duplicate sampling procedures should be used to provide a relative measure of the precision of the sample collection process. A duplicate sample should be collected at the first outfall inspection of an outfall screening day. These samples will be collected at the same time, using the same procedures, the same type of equipment, and in the same type of sample container. Outfall screening data forms should be filled out for these duplicate samples and clearly marked as a QC duplicate sample. Copies of the outfall screening data for duplicate samples will be kept in the project files and will be routinely examined to determine whether any problems are evident with specific sampling procedures or test kit analyses. A blank sample, using distilled water, should be tested at the beginning of each screening season or when a new test kit is used. Positive results for any of the parameters being tested would indicate a problem with the test kit.

SUMMARY OF OUTFALL SCREENING ACTIVITIES

A summary of the major steps for outfall screening follows (more detailed discussions of these steps are presented in Appendix I):

Step 1: Review Outfall Screening Subsection of Training Manual.
Step 2: Obtain and Organize Outfall Screening Equipment.
Step 3: Conduct a Trial Run of Outfall Screening Procedures (At Initiation of Outfall Screening Activities and As Needed).
Step 4: Monitor Weather for Outfall Screening Window of Opportunity.
Step 5: Check Schedule of Outfalls to Be Screened.
Step 6: Conduct First Scheduled Outfall Inspection.
Step 7: Proceed to Remaining Outfalls Scheduled for Inspection.
Step 8: Return to Office/Conduct Daily Closeout Activities.

FOLLOW-UP INVESTIGATION AND PROGRAM EVALUATION

If the outfall screening identified dry-weather flows, several of the screening indicators will more than likely test positive for pollutant discharges. The screening results should be reviewed to determine the magnitude of the dry-weather pollution problem and to determine the necessary steps to identify and remove the sources of any detected pollutants. Figure 4 presents a flow chart for the Follow-Up Investigation and Program Evaluation component of the program. This component consists of the following tasks:

- Outfall screening results review and assessment,
- Detailed storm sewer investigation and source identification,
- Removal of inappropriate discharges, and
- Program evaluation.

OUTFALL SCREENING RESULTS REVIEW AND ASSESSMENT

Data from the daily outfall screening forms should be compiled into a summary form to allow for easy review of the community-wide results. An example outfall screening summary table is provided as Table 4.

Figure 4: FOLLOW- UP INVESTIGATION AND PROGRAM EVALUATION

FROM OUTFALL SCREENING

OUTFALL SCREENING RESULTS REVIEW & ASSESSMENT

DETAILED STORM SEWER INVESTIGATION AND SOURCE IDENTIFICATION

REMOVAL OF INAPPROPRIATE DISCHARGES

PROGRAM EVALUATION

Table 3
EXAMPLE OUTFALL SCREENING PROGRAM DATA SUMMARY TABLE

Sample Point	Flow Observed?	Inspection Date	Color	Turbidity	Odor	Oil Sheen	Scum	pH	Chlorine	Copper	Detergents	Ammonia	Phenol

First, the summary should be reviewed to identify any potential trends of observed positive test results. Examples of trends would be if the outfalls with positive results are located in one general area of the community or are randomly distributed or whether they are located primarily in industrial or older areas.

Secondly, the results should be reviewed to identify what might be potentially more serious problems (for example, outfalls with multiple positive test results or high or extreme results). One method to estimate the magnitude of an outfall pollution problem is to evaluate the pollutant in terms of its flow and concentration. Multiplying the concentration by the flow (with the appropriate conversion) provides an indicator of the amount, or loading, of that pollutant being discharged into receiving waters. To estimate the annual loading:

Multiply the concentration (ppm) x the flow (fal/min) x 4.4 = loading (lbs/yr)

or

Multiply the concentration (ppm) x the flow (ft^3/sec) x 1,970 = loading (lbs/yr)

Outfalls with the highest pollutant loads should be designated as highest priority for follow-up investigation to identify and eliminate pollutant sources.

Detailed investigations of the storm sewer system may be required upstream of the outfalls to locate sources of illicit discharges or improper disposal. The detailed investigations will be based on evaluation of the data from the initial outfall screening. This element of the program will serve to detect pollution sources for correction. The program to investigate and remove inappropriate discharges will involve targeting sewer system areas for detailed investigation and then conducting intensive field investigations upstream of the polluted outfall to identify sources.

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DETAILED STORM SEWER INVESTIGATION AND SOURCE IDENTIFICATION

The program for detailed storm sewer investigation and source identification has three major components: 1) mapping and evaluation, 2) field surveys, and 3) source identification.

Mapping and Evaluation

For each outfall to be investigated, a large-scale working map should be obtained that includes the entire upstream storm sewer network highlighted, drainage area delineated, and parcel boundaries indicated. Land use information should be evaluated to determine the types of residential, commercial, and industrial areas that might contribute the type of pollution identified at the outfall.

Outfall screening observations should be evaluated with consideration given to the types of land uses that discharge stormwater into the sewer system upstream of the outfall screening point. Commercial/industrial land uses will be targeted for these investigations. Special attention should be given to sanitary, industrial, commercial, septic tanks, and vehicle maintenance activities as potential pollution sources. In addition, attempts should be made to match detected indicators with upstream activities.

Field Surveys

After conducting the mapping evaluation, a manhole-by-manhole inspection should be conducted to pinpoint the location in the storm sewer system that is the source of the inappropriate discharge. This inspection requires a two-person crew to revisit the outfall where the polluted dry-weather discharge was detected. The outfall should be revisited as soon as it is practicable after the dry-weather outfall screening. The field crew will be equipped with the same testing and safety equipment used during the initial outfall screening. After confirming that dry-weather flow is present at the outfall, the field crew should move to the next upstream manhole or access point. **IN NO CASE SHOULD FIELD CREWS WHO ARE UNTRAINED AND/OR UNEQUIPPED FOR CONFINED SPACE ENTRY ATTEMPT TO ENTER CONFINED SPACES.** If flow is present at this manhole, a sample should be collected and analyzed using the same procedures as in the initial outfall screening. A description and location of the manhole should be recorded as well. The field crew should evaluate any commercial/industrial facilities, residences, or other land uses in the proximity of the manhole to try to identify potential sources of inappropriate discharges or improper disposal.

Once dry-weather flow at an upstream manhole has been identified as being consistent with the initially identified inappropriate discharge, the field crew should move to the next upstream manhole and repeat the procedures. In cases where more than one source of dry-weather discharge enters a manhole, the field crew should record this information on the screening form and then track each source separately. All sources should be tracked upstream, manhole-by-manhole, until the dry-weather discharge is no longer detected. The field crew should identify the last manhole where dry-weather flow is present and assess the potential sources in the proximity of that manhole. These data will be important for source identification.

The field crew should also determine whether there has been a change in the flow rate between manholes. If the flow rate appears to have changed between two manholes in the system, an illicit connection could likely exist between the two manholes. Changes in the concentration of pollutant parameters could also aid in confirming the presence of an illicit connection between the two manholes.

Source Identification

Once the manhole inspection has identified an outfall, area (between two manholes) suspected of containing an inappropriate discharge, source testing will be necessary. If there is only one possible source to this section of the storm sewer system in the area (for example, a pipe discharging gasoline from a tank farm), source identification and follow-up for corrective action should be

straightforward. Multiple sources, or non-definitive sources, may require additional evaluation and testing such as fluorometiric dye testing, smoke testing, and/or remote video inspections, including collecting samples for laboratory analysis. Collection of samples for laboratory analysis should be considered in instances where multiple potential sources exist or where the suspected generator of the pollutant is resistive or uncooperative in identifying the problem.

The following discussions of potential sources of pollutant indicators can be used in matching detected indicators with potential sources.

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. 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 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.

Copper

Concentrations of copper in dry-weather flows can be a result of corrosion of water pipes and automotive sources (for example, radiators, brake lines, and electrical equipment). The occurrence of copper in dry-weather flows could also be caused by inappropriate discharges from facilities that either use or manufacture copper-based products.

Industrial sources of copper include the following:

- Copper manufacturing (smelting),
- Copper metal processing/scrap remelting,
- Metal plating,
- Chemicals manufacturing,
- Analytical laboratories,
- Power plants,
- Electronics,
- Wood preserving, and
- Copper wire production.

In each of these industries, wastes containing copper would normally be discharged to a treatment facility. Sludge from the waste treatment facility, whether on-site (including lagooning) or publicly operated treatment facilities, would contain copper. If the sludge (or the treatment process) is not managed properly, copper could enter the storm sewer system.

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. 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.

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 seepage 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 TideTM 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.

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.

Odor

Water is a neutral medium and does not produce odor; however, most organic and some inorganic chemicals contribute odor to water. Odor in water may originate from municipal and industrial waste discharges, from natural sources such as decomposition of vegetative matter, or from associated microbial activity. Odor is recognized as a quality factor affecting the acceptability of

drinking water, tainting of aquatic life, and aesthetics of recreational waters. Odor is generally a good indicator of illicit sanitary sewer connections to a municipal sewer system.

Oil Sheen/Surface Scum

The presence of an oil sheen in dry-weather flow discharges from a municipal storm sewer system may indicate the presence of a leaking underground storage tank in the vicinity or illegal dumping of items such as used automobile oil into the storm sewer system. Surface scum in dry-weather flow may consist of floatable materials such as foam, grease, waxes, soaps, food wastes, hair, paper and cotton, grit particles, and other materials. Surface scum may also indicate the presence of detergents or other chemicals in dry-weather flow. In addition, surface scum is an important parameter to note in the outfall screening program because it is subject to wind-induced transport in the receiving water and may contain pathogenic bacteria and/or viruses associated with individual particles.

Phenol

Phenol is a very commonly occurring chemical and can be found in foods, medicines, and cleaning products, as well as industrial products and by-products. Generally, the appearance of phenols in stormwater would indicate a misconnected industrial sewer to a storm drain or ditch. Exceptions would include runoff from treated wood storage yards (for example, treated lumber and telephone poles) and improper disposal of cleaning products.

Industrial sources of phenol include the following:

- Chemical manufacturing (organic),
- Textile manufacturing,
- Paint and coatings manufacturing,
- Metal coating,
- Resin manufacturing,
- Tire manufacturing,
- Plastics fabricating,
- Electronics,
- Oil refining and re-refining,
- Naval stores (turpentine and other wood treatment chemicals),
- Pharmaceutical manufacturing,
- Paint stripping (for example, automotive and aircraft),
- Military installations (rework and repair facilities),
- Coke manufacturing,
- Iron production, and
- Ferro-alloy manufacturing.

Other sources of phenol include improper handling and disposal of cleaning compounds by institutions such as hospitals and nursing homes.

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. 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.

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. 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.

It should be noted that not all dry-weather flows are considered inappropriate discharges. Under certain conditions, the following discharges are not considered inappropriate by USEPA:

- Water line flushing,
- Landscaping irrigation,
- Diverted stream flows,
- Rising groundwaters,
- Uncontaminated groundwater infiltration,
- Uncontaminated pumped groundwater,
- Discharges from potable water sources,
- Flows from foundation drains,
- Air conditioning condensation,
- Irrigation water,
- Springs,
- Water from crawl spaces,
- Lawn watering,
- Individual car washing,
- Flows from riparian habitats and wetlands,
- Dechlorinated swimming pool water, and
- Street wash water.

Final determination of the source of the inappropriate discharge will possibly require facility inspections. If an inspection of a facility is required, notification to the facility owner or manager and scheduling of the inspection will be required.

REMOVAL OF ILLICT DISCHARGES

Note: Investigation of facilities for sources of inappropriate discharges and removal of inappropriate discharges requires that the appropriate legal authority for inspections and enforcement be established. The following discussion of compliance enforcement activities assumes that the municipal department conducting the inspection has the appropriate legal authority.

Five steps should be taken to definitively identify and remove an inappropriate discharge to the storm sewer system. These steps are as follow:

Step 1. Send a notification letter to the owner/operator of the property/site suspected of discharging a pollutant. Request that the owner/operator describe the activities on the site and the possible sources of non-stormwater discharges. Information regarding the use and storage of hazardous substances, chemical storage practices, materials handling and disposal practices, storage tanks, types of permits, and pollution prevention plans should be requested.

Step 2: Arrange a meeting for an inspection of the facility between municipal inspectors and the owner/operator of the property where the pollution source is suspected. Most illicit connections and improper disposal can probably be detected during this step. Site owners/operators should then be made aware of the problem and should be encouraged to take voluntary corrective measures.

Step 3: Conduct additional tests as necessary if the initial site inspection is not successful in identifying the source of the problem. Fluorometric dye tests of plumbing fixtures and floor drains, smoke tests, and/or remote video inspection can be used to pinpoint sources.

Step 4: Issue a notice of noncompliance if the owner/operator does not voluntarily initiate corrective action. Upon notification of noncompliance, the owner can be subject to any penalties stipulated in the stormwater quality ordinance.

Step 5: Conduct follow-up inspections to determine whether corrective actions have been implemented to remove the illicit connection or eliminate the improper disposal practice. This inspection should be conducted after the owner/operator has had reasonable time to assess the problem and take corrective action. Flagrant violation or disregard of the ordinance can result in daily penalties, if stipulated in the ordinance.

The Village responsibility for each of these steps will vary depending on the nature of the source. For example, if an illicit connection or improper disposal procedure is traced to an industrial facility that is unaware of the problem, the municipality should send a letter to the facility notifying the owner or operator of the problem. Certain industrial facilities are responsible for obtaining NPDES stormwater discharge permits (this information is provided in the industrial facility database in Appendix I). The NPDES regulations identify facilities requiring permits by SIC codes. Some SIC codes automatically require a facility to obtain an NPDES permit; other SIC codes only require a facility to obtain a permit if certain operations come into contact with stormwater (see Table 5). ***(The U.S. Office of Management and Budget's document, "Standard Industrial Classification Manual" should be referenced for descriptions of SIC codes).*** Facilities applying for an NPDES stormwater permit are required to certify that they have no illicit connections. Responsibility for investigation and compliance of this issue rests with IEPA. Additionally, if an inappropriate discharge is determined to be an illicit-sanitary sewer connection to the storm sewer system, the municipality should contact the appropriate sanitary agency, which should take action according to its current policies to correct such problems.

PROGRAM EVALUATION

The outfall screening results will most likely identify a number of outfalls with dry-weather flow. Outfalls with dry-weather flow may range from 10 to 40 percent of the outfalls screened in the program. Typically, the majority of these outfalls will test positive for one or more of the pollutant indicators in the screening program.

The results of the screening program should be reviewed to examine whether any trends can be identified that relate the incidence of dry-weather flow observations to the age or land use of a developed area. Experience gained from the USEPA NPDES program indicates a lower chance of observing polluted dry-weather flows in residential and newer development areas, with older and industrial land use areas having a higher incidence of observed dry-weather flows. The municipality should examine the screening results to determine whether any such obvious conclusions can be made. If so, these conclusions may guide future outfall screening activities.

Outfalls with positive indicators of potential pollution should be investigated further to identify and eliminate upstream pollutant sources. Illicit direct connections will be corrected and should be eliminated as a potential source of pollutants. However, new sources may appear in the future as a result of mistaken cross connections from redevelopment, remodeling, or new development. Indirect or subtle discharges such as dumping are difficult to trace to their sources and can only be remedied through public education and reporting. Therefore, although the outfall screening program will be successful in identifying and eliminating pollutants in dry-weather discharges, it is expected that to some degree, they will continue, although a reduced magnitude and frequency. The continued existence of dry-weather flows and associated pollutants will require an ongoing commitment by the municipality to continue the outfall screening program.

In the absence of specific state or federal regulations that require screening, the municipality should consider annual outfall screening. The annual screening will determine the effectiveness of the program on a long-term basis and should show ongoing improvement through a reduced number of outfalls with positive indicators of potential pollutants. It is logical to assume that after several years of screening, the majority of the dry-weather pollution sources should be eliminated. At that time, the municipality may consider reducing the frequency of outfall screening to once every several years or so, if warranted.

Table 5: NPDES-IDENTIFIED INDUSTRIAL FACILITIES

SIC Code	Description
	Facilities subject to stormwater effluent limitations guidelines, new source performance standards, or toxic pollutant effluent standards under 40 CFR Subchapter N (except facilities with toxic pollutant effluent standards that are exempted).
1000-1400	Mineral industry, including active and inactive mining operations, with exceptions, and certain oil and gas exploration, production, processing, or treatment operations or transmission facilities.
2400	Lumber and wood products except furniture (except 2434-wood kitchen cabinets)
2600	Paper and allied products (except 2650-paperboard containers and boxes from purchased paperboard and 2670-converted paper and paperboard products)
2800	Chemicals and allied products (except 2830-drugs)
2900	Petroleum refining and related industries (except discharges subject to 40 CFR 419)
3110	Leather tanning and finishing
3200	Stone, clay, glass, and concrete products (except discharges subject to 40 CFR 419)
3300	Primary metal industries
3441	Fabricated structural metal
3730	Ship and boat building and repair
	Hazardous waste treatment, storage, or disposal facilities, including those that are operating under interim status or a permit under Subtitle C of RCRA
	Landfills, land application sites, and open dumps that receive or have received any industrial wastes, including those that are subject to regulation under Subtitle D of RCRA
	Facilities involved in the recycling of materials, including metal scrap yards, battery reclaimers, salvage yards, and automobile junkyards, including, but not limited to, those classified as SIC codes 5015 (used motor vehicle parts) and 5093 (scrap and waste materials).
	Stream electric power generating facilities including coal handling sites
	Transportation facilities with vehicle maintenance shops, equipment cleaning operations, or airport deicing operations (except facilities with SIC codes 4221 through 4225) (only those portions of the facility that are either involved in vehicle maintenance including vehicle rehabilitation, mechanical repairs, painting, fueling, and lubrication), equipment cleaning operations, airport deicing operations, or that are otherwise identified as an industrial facility.
	Construction activity including clearing, grading, and excavation activities except: operations that result in the disturbance of less than 5 acres of total land that are not part of a larger common plan of development or sale
THE FOLLOWING SIC CODES REQUIRE AN NPDES PERMIT IF CERTAIN ACTIVITIES ARE EXPOSED TO STORMWATER	
2000	Food and kindred products manufacturing or processing
2100	Tobacco products
2200	Textile mill products
2300	Apparel and other finished products made from fabrics and similar materials
2434	Wood kitchen cabinets
2500	Furniture and fixtures
2650	Paperboard containers and boxes
2670	Converted paper and paperboard products
2700	Printing, publishing, and allied industries
2830	Drugs
2850	Paperboard containers and boxes
3000	Rubber and miscellaneous products
3100	Leather and leather products (except 3110-leather tanning and finishing)
3230	Glass products, made of purchased glass
3400	Fabricated metal products, except machinery and transportation equipment (except 3441-fabricated structural metal)
3500	Industrial and commercial machinery and computer equipment
3600	Electronic and other electrical equipment and components, except computer equipment
3700	Transportation equipment (except 3730-ship and boat building and repairing)
3800	Measuring, analyzing, and controlling instruments; photographic, medical, and optical goods; watches and clocks
3900	Miscellaneous manufacturing industries
4221-4225	Farm products warehousing and storage, refrigerated warehousing and storage, general warehousing and storage

APPENDIX A

IDDE AND NPDES RESOURCES

IDDE AND NPDES RESOURCES

US Environmental Protection Agency

NPDES Main Webpage
http://cfpub.epa.gov/npdes/index.cfm

National Menu of Stormwater Best Management Practices
http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm

Code of Federal Regulations- NPDES
http://www.epa.gov/npdes/regulations/122_26.txt

Illinois Environmental Protection Agency

NPDES Phase II Main Webpage
http://www.epa.state.il.us/water/permits/storm-water

General NPDES Permit No. ILR40
http://www.epa.state.il.us/water/permits/storm-water/general-ms4-permit.pdf

Center for Watershed Protection- www.cwp.org

Illicit Discharge Detection and Elimination Guidance Manual- Free Download
http://cwp.org.master.com/texis/master/search/+/form/New_IDDE.html

APPENDIX B

MODEL ILLICIT DISCHARGE ORDINANCE

From the Center for Watershed Protection

MODEL ILLICIT DISCHARGE AND CONNECTION ORDINANCE

Introduction to the Model Illicit Discharge and Connection Ordinance

The model ordinance provided in this Appendix is intended to be a tool for communities who are responsible for meeting the illicit discharge detection and correction requirements of the National Pollutant Discharge Elimination System (NPDES) regulations. This model ordinance is provided to assist communities in creating their own illicit discharge ordinances. In designing this model, an attempt was made to avoid creating too complex an ordinance, and instead to provide standard language and concepts that a good illicit discharge ordinance might contain. The language was borrowed from a number of ordinances.

Feel free to use and alter any and all portions of this document to meet the needs of the local community. Throughout the ordinance, there are sections in which the name of the agency to which regulatory power over illicit discharges has been given should be filled in to customize it. These sections are denoted by text placed in brackets – [authorized enforcement agency].

Italicized text with this symbol _ should be interpreted as comments, instructions, or information to assist local governments in tailoring the ordinance. This text would not appear in a final adopted ordinance. This ordinance should not be construed as an exhaustive listing of all the language needed for a local ordinance, but represents a good base that communities can build upon and customize to be consistent with the staff resources available in their locality. It is recommended that this document be used in conjunction with other sources, such as existing ordinances created by other IDDE programs in the same geographic region and with similar objectives. In addition, several state agencies, councils of governments, and other regional groups have developed model ordinances. Two very comprehensive yet different examples of ordinances are:

- Model Storm Water Ordinance
  Source: North Central Texas Council of Governments (www.dfwstormwater.com/illicits)

- Model Illicit Discharge and Illegal Connection Ordinance
  Source: Metropolitan North Georgia Water Planning District
  (www.northgeorgiawater.com)

For those areas where septic systems are commonly used for wastewater treatment, language requiring inspection of these systems should also be added. The Washtenaw County (MI) *Regulation for the Inspection of Residential On-site Water and Sewage Disposal Systems at Time of Property Transfer* is an example of an ordinance that specifies requirements for inspection and maintenance of septic systems.

MODEL ILLICIT DISCHARGE AND CONNECTION ORDINANCE

ORDINANCE NO. _____

SECTION 1. PURPOSE/INTENT.

The purpose of this ordinance is to provide for the health, safety, and general welfare of the citizens of **[jurisdiction]** through the regulation of non-storm water discharges to the storm drainage system to the maximum extent practicable as required by federal and state law. This ordinance establishes methods for controlling the introduction of pollutants into the municipal separate storm sewer system (MS4) in order to comply with requirements of the National Pollutant Discharge Elimination System (NPDES) permit process. The objectives of this ordinance are:

(1) To regulate the contribution of pollutants to the MS4 by storm water discharges by any user.
(2) To prohibit illicit connections and discharges to the MS4.
(3) To establish legal authority to carry out all inspection, surveillance, monitoring, and enforcement procedures necessary to ensure compliance with this ordinance.

SECTION 2. DEFINITIONS.

For the purposes of this ordinance, the following shall mean:

Authorized Enforcement Agency. Employees or designees of the director of the municipal agency designated to enforce this ordinance.

Best Management Practices (BMPs). Schedules of activities, prohibitions of practices, general good house keeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to storm water, receiving waters, or storm water conveyance systems. BMPs also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw materials storage.

Clean Water Act. The federal Water Pollution Control Act (33 U.S.C. § 1251 et seq.), and any subsequent amendments thereto. Construction Activity. Activities subject to NPDES Construction Permits. These include construction projects resulting in land disturbance of one acre or more. Such activities include but are not limited to clearing and grubbing, grading, excavating, and demolition.

Hazardous Materials. 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.
Illegal Discharge. Any direct or indirect non-storm water discharge to the storm drain system, except as exempted in Section 8 of this ordinance.

Illicit Connections. An illicit connection is defined as either of the following:

- Any drain or conveyance, whether on the surface or subsurface that allows an illegal

discharge to enter the storm drain system including but not limited to any conveyances that allow any non-storm water discharge including sewage, process wastewater, and wash water to enter the storm drain system and any connections to the storm drain system from indoor drains and sinks, regardless of whether said drain or connection had been previously allowed, permitted, or approved by an authorized enforcement agency or,

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

Industrial Activity. Activities subject to NPDES Industrial Storm Water Permits as defined in 40 CFR, Section 122.26 (b)(14).

Municipal Separate Storm Sewer System (MS4). The system of conveyances (including sidewalks, roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) owned and operated by the **[jurisdiction]** and designed or used for collecting or conveying storm water, and that is not used for collecting or conveying sewage.

National Pollutant Discharge Elimination System (NPDES) Storm Water Discharge Permit. means a permit issued by EPA (or by a State under authority delegated pursuant to 33 USC § 1342(b)) that authorizes the discharge of pollutants to waters of the United States, whether the permit is applicable on an individual, group, or general area-wide basis.

Non-Storm Water Discharge. Any discharge to the storm drain system that is not composed entirely of storm water.

Person. Any individual, association, organization, partnership, firm, corporation or other entity recognized by law and acting as either the owner or as the owner's agent.

Pollutant. Anything which causes or contributes to pollution. Pollutants may include, but are not limited to: paints, varnishes, and solvents; oil and other automotive fluids; non-hazardous liquid and solid wastes and yard wastes; refuse, rubbish, garbage, litter, or other discarded or abandoned objects, ordinances, and accumulations, so that same may cause or contribute to pollution; floatables; pesticides, herbicides, and fertilizers; hazardous substances and wastes; sewage, fecal coliform and pathogens; dissolved and particulate metals; animal wastes; wastes and residues that result from constructing a building or structure; and noxious or offensive matter of any kind.
Premises. Any building, lot, parcel of land, or portion of land whether improved or unimproved including adjacent sidewalks and parking strips.

Storm Drainage System. Publicly-owned facilities by which storm water 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 human-made or altered drainage channels, reservoirs, and other drainage structures.

Storm Water. Any surface flow, runoff, and drainage consisting entirely of water from any form of natural precipitation, and resulting from such precipitation.

Storm Water Management Plan. 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 Storm Water, Storm Water Conveyance Systems, and/or Receiving Waters to the Maximum Extent Practicable.

Wastewater. Any water or other liquid, other than uncontaminated storm water, discharged from a facility.

SECTION 3. APPLICABILITY.

This ordinance shall apply to all water entering the storm drain system generated on any developed and undeveloped lands unless explicitly exempted by the **[authorized enforcement agency]**.

SECTION 4. RESPONSIBILITY FOR ADMINISTRATION.

The **[authorized enforcement agency]** shall administer, implement, and enforce the provisions of this ordinance. Any powers granted or duties imposed upon the **[authorized enforcement agency]** may be delegated in writing by the Director of the **[authorized enforcement agency]** to persons or entities acting in the beneficial interest of or in the employ of the agency.

SECTION 5. COMPATIBILITY WITH OTHER REGULATIONS.

This ordinance is not intended to modify or repeal any other ordinance, rule, regulation, or other provision of law. The requirements of this ordinance are in addition to the requirements of any other ordinance, rule, regulation, or other provision of law, and where any provision of this ordinance imposes restrictions different from those imposed by any other ordinance, rule, regulation, or other provision of law, whichever provision is more restrictive or imposes higher protective standards for human health or the environment shall control.

SECTION 6. SEVERABILITY.

The provisions of this ordinance are hereby declared to be severable. If any provision, clause, sentence, or paragraph of this ordinance or the application thereof to any person, establishment, or circumstances shall be held invalid, such invalidity shall not affect the other provisions or application of this ordinance.

SECTION 7. ULTIMATE RESPONSIBILITY.

The standards set forth herein and promulgated pursuant to this ordinance are minimum standards; therefore this ordinance does not intend or imply that compliance by any person will ensure that there will be no contamination, pollution, or unauthorized discharge of pollutants.

SECTION 8. DISCHARGE PROHIBITIONS.

8.1. Prohibition of Illegal Discharges.

No person shall throw, drain, or otherwise discharge, cause, or allow others under its control to throw, drain, or otherwise discharge into the MS4 any pollutants or waters containing any pollutants, other than storm water.

The commencement, conduct or continuance of any illegal discharge to the storm drain system is prohibited except as described as follows:

(1) The following discharges are exempt from discharge prohibitions established by this ordinance: water line flushing, landscape irrigation, diverted stream flows, rising ground waters, uncontaminated ground water infiltration, uncontaminated pumped ground water, 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, and street wash water.

(2) Discharges or flow from firefighting, and other discharges specified in writing by the **[authorized enforcement agency]** as being necessary to protect public health and safety.

(3) Discharges associated with dye testing, however this activity requires a verbal notification to the **[authorized enforcement agency]** prior to the time of the test.

(4) The prohibition shall not apply to any non-storm water discharge permitted under an NPDES permit, waiver, or waste discharge order issued to the discharger and administered under the authority of the United States Environmental Protection Agency (EPA), 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 drain system.

_ The local government may evaluate and remove any of the above exemptions if it is determined that they are causing an adverse impact.

8.2. Prohibition of Illicit Connections.

(1) The construction, use, maintenance or continued existence of illicit connections to the storm drain system is prohibited.

(2) 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.

(3) A person is considered to be in violation of this ordinance if the person connects a line conveying sewage to the MS4, or allows such a connection to continue.

(4) Improper connections in violation of this ordinance must be disconnected and redirected, if necessary, to an approved onsite wastewater management system or the sanitary sewer system upon approval of the **[authorized enforcement agency]**.

(5) Any drain or conveyance that has not been documented in plans, maps or equivalent, and which may be connected to the storm sewer system, shall be located by the owner or occupant of that property upon receipt of written notice of violation from the **[authorized enforcement agency]** requiring that such locating be completed. Such notice will specify a reasonable time period within which the location of the drain or conveyance is to be determined, that the drain or conveyance be identified as storm sewer, sanitary sewer or other, and that the outfall location or point of connection to the storm sewer system, sanitary sewer system or other discharge point be identified.

Results of these investigations are to be documented and provided to the **[authorized enforcement agency]**.

SECTION 9. WATERCOURSE PROTECTION.

Every person owning property through which a watercourse passes, or 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.

SECTION 10. INDUSTRIAL OR CONSTRUCTION ACTIVITY DISCHARGES.

10.1. Submission of NOI to [jurisdiction].

(1) Any person subject to an industrial or construction activity NPDES storm water discharge permit shall comply with all provisions of such permit. Proof of compliance with said permit may be required in a form acceptable to the **[authorized enforcement agency]** prior to the allowing of discharges to the MS4.

(2) The operator of a facility, including construction sites, required to have an NPDES permit to discharge storm water associated with industrial activity shall submit a copy of the Notice of Intent (NOI) to the **[authorized enforcement agency]** at the same time the operator submits the original Notice of Intent to the EPA as applicable.

(3) The copy of the Notice of Intent may be delivered to the **[authorized enforcement agency]** either in person or by mailing it to:

> Notice of Intent to Discharge Storm Water
> **[authorized enforcement agency]**
> **[street address]**
> **[city, state, zip code]**

(4) A person commits an offense if the person operates a facility that is discharging storm water associated with industrial activity without having submitted a copy of the Notice of Intent to do so to the **[authorized enforcement agency]**.

SECTION 11. COMPLIANCE MONITORING

11.1. Right of Entry: Inspection and Sampling.

The **[authorized enforcement agency]** shall be permitted to enter and inspect facilities subject to regulation under this ordinance as often as may be necessary to determine compliance with this ordinance.

(1) 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 **[authorized enforcement agency]**.

(2) Facility operators shall allow the **[authorized enforcement agency]** ready 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 an NPDES permit to discharge storm water, and the performance of any additional duties as defined by state and federal law.

(3) The **[authorized enforcement agency]** shall have the right to set up on any permitted facility such devices as are necessary in the opinion of the **[authorized enforcement agency]** to conduct monitoring and/or sampling of the facility's storm water discharge.

(4) The **[authorized enforcement agency]** has the right to require the discharger to install monitoring equipment as necessary. The facility's sampling and monitoring equipment shall be maintained at all times in a safe and proper operating condition by the discharger at its own expense. All devices used to measure storm water flow and quality shall be calibrated to ensure their accuracy.

(5) Any temporary or permanent obstruction to safe and easy access to the facility to be inspected and/or sampled shall be promptly removed by the operator at the written or oral request of the **[authorized enforcement agency]** and shall not be replaced. The costs of clearing such access shall be borne by the operator.

(6) Unreasonable delays in allowing the **[authorized enforcement agency]** access to a permitted facility is a violation of a storm water discharge permit and of this ordinance. A person who is the operator of a facility with an NPDES permit to discharge storm water associated with industrial activity commits an offense if the person denies the **[authorized enforcement agency]** reasonable access to the permitted facility for the purpose of conducting any activity authorized or required by this ordinance.

11.2. Search Warrants.

If the **[authorized enforcement agency]** has been refused access to any part of the premises from which storm water is discharged, and he/she is able to demonstrate probable cause to believe that there may be a violation of this ordinance, or that there is a need to inspect and/or sample as part of a routine inspection and sampling program designed to verify compliance with this ordinance or any order issued hereunder, or to protect the overall public health, safety, and welfare of the community, then the **[authorized enforcement agency]** may seek issuance of a search warrant from any court of competent jurisdiction.

SECTION 12. REQUIREMENT TO PREVENT, CONTROL, AND REDUCE STORM WATER POLLUTANTS BY THE USE OF BEST MANAGEMENT PRACTICES.

[Authorized enforcement agency] will adopt requirements identifying Best Management Practices for any activity, operation, or facility which may cause or contribute to pollution or contamination of storm water, the storm drain system, or waters of the United States. The owner or operator of such activity, operation, or facility shall provide, at their own expense, reasonable protection from accidental discharge of prohibited materials or other wastes into the municipal storm drain system or watercourses through the use of these structural and non-structural BMPs.

Further, any person responsible for a property or premise that is, or may be, the source of an illicit discharge, may be required to implement, at said person's expense, additional structural and non-structural BMPs to prevent the further discharge of pollutants to the MS4. Compliance with all terms and conditions of a valid NPDES permit authorizing the discharge of storm water associated with industrial activity, to the extent practicable, shall be deemed compliance with the provisions of this section. These BMPs shall be part of a storm water management plan (SWMP) as necessary for compliance with requirements of the NPDES permit.

SECTION 13. NOTIFICATION OF SPILLS.

Notwithstanding other requirements of law, as soon as any person responsible for a facility or operation, or responsible for emergency response for a facility or operation has information of any known or suspected release of materials which are resulting or may result in illegal discharges or pollutants discharging into storm water, the storm drain system, or waters of the United States, said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release. In the event of such a release of hazardous materials said person shall immediately notify emergency response agencies of the occurrence via emergency dispatch services. In the event of a release of non-hazardous materials, said person shall notify the **[authorized enforcement agency]** in person or by phone or facsimile no later than the next business day. Notifications in person or by phone shall be confirmed by written notice addressed and mailed to the **[authorized enforcement agency]** within **[___]** business days of the phone 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 **[___]** years. Failure to provide notification of a release as provided above is a violation of this ordinance.

SECTION 14. VIOLATIONS, ENFORCEMENT, AND PENALTIES.

14.1. Violations.

It shall be unlawful for any person to violate any provision or fail to comply with any of the requirements of this ordinance. Any person who has violated or continues to violate the provisions of this ordinance, may be subject to the enforcement actions outlined in this section or may be restrained by injunction or otherwise abated in a manner provided by law. In the event the violation constitutes an immediate danger to public health or public safety, the **[authorized enforcement agency]** is authorized to enter upon the subject private property, without giving prior notice, to take any and all measures necessary to abate the violation and/or restore the property. The **[authorized enforcement agency]** is authorized to seek costs of the abatement as outlined in Section 17.

14.2. Warning Notice.

When the **[authorized enforcement agency]** finds that any person has violated, or continues to violate, any provision of this ordinance, or any order issued hereunder, the **[authorized enforcement agency]** may serve upon that person a written Warning Notice, specifying the particular violation believed to have occurred and requesting the discharger to immediately investigate the matter and to seek a resolution whereby any offending discharge will cease.

Investigation and/or resolution of the matter in response to the Warning Notice in no way relieves the alleged violator of liability for any violations occurring before or after receipt of the Warning Notice. Nothing in this subsection shall limit the authority of the **[authorized enforcement agency]** to take any action, including emergency action or any other enforcement action, without first issuing a Warning Notice.

14.3. Notice of Violation.

Whenever the **[authorized enforcement agency]** finds that a person has violated a prohibition or failed to meet a requirement of this ordinance, the **[authorized enforcement agency]** may order compliance by written notice of violation to the responsible person. The Notice of Violation shall contain:

(1) The name and address of the alleged violator;

(2) The address when available or a description of the building, structure or land upon which the violation is occurring, or has occurred;

(3) A statement specifying the nature of the violation;

(4) A description of the remedial measures necessary to restore compliance with this ordinance and a time schedule for the completion of such remedial action;

(5) A statement of the penalty or penalties that shall or may be assessed against the person to whom the notice of violation is directed;

(6) A statement that the determination of violation may be appealed to the **[authorized enforcement agency]** by filing a written notice of appeal within **[___]** days of service of notice of violation; and

(7) A statement specifying that, should the violator fail to restore compliance within the established time schedule, the work will be done by a designated governmental agency or a contractor and the expense thereof shall be charged to the violator.

Such notice may require without limitation:

(1) The performance of monitoring, analyses, and reporting;
(2) The elimination of illicit connections or discharges;
(3) That violating discharges, practices, or operations shall cease and desist;
(4) The abatement or remediation of storm water pollution or contamination hazards and the restoration of any affected property
(5) Payment of a fine to cover administrative and remediation costs; and
(6) The implementation of source control or treatment BMPs.

14.5. Compensatory Action.

In lieu of enforcement proceedings, penalties, and remedies authorized by this ordinance, the **[authorized enforcement agency]** may impose upon a violator alternative compensatory actions, such as storm drain stenciling, attendance at compliance workshops, creek cleanup, etc.

14.6. Suspension Of MS4 Access.

14.6.1. Emergency Cease and Desist Orders

When the **[authorized enforcement agency]** finds that any person has violated, or continues to violate, any provision of this ordinance, or any order issued hereunder, or that the person's past violations are likely to recur, and that the person's violation(s) has (have) caused or contributed to an actual or threatened discharge to the MS4 or waters of the United States which reasonably appears to present an imminent or substantial endangerment to the health or welfare of persons or to the environment, the **[authorized enforcement agency]** may issue an order to the violator directing it immediately to cease and desist all such violations and directing the violator to:

(1) Immediately comply with all ordinance requirements; and
(2) Take such appropriate preventive action as may be needed to properly address a continuing or threatened violation, including immediately halting operations and/or terminating the discharge.

Any person notified of an emergency order directed to it under this Subsection shall immediately comply and stop or eliminate its endangering discharge. In the event of a discharger's failure to immediately comply voluntarily with the emergency order, the **[authorized enforcement agency]** may take such steps as deemed necessary to prevent or minimize harm to the MS4 or waters of the United States, and/or endangerment to persons or to the environment, including immediate termination of a facility's water supply, sewer connection, or other municipal utility services. The **[authorized enforcement agency]** may allow the person to recommence its discharge when it has demonstrated to the satisfaction of the **[authorized enforcement agency]** that the period of endangerment has passed, unless further termination proceedings are initiated against the discharger under this ordinance. A person that is responsible, in whole or in part, for any discharge presenting imminent endangerment shall submit a detailed written statement, describing the causes of the harmful discharge and the measures taken to prevent any future occurrence, to the **[authorized enforcement agency]** within **[___]** days of receipt of the emergency order. Issuance of an emergency cease and desist order shall not be a bar against, or a prerequisite for, taking any other action against the violator.

14.6.2. Suspension due to Illicit Discharges in Emergency Situations

The **[authorized enforcement agency]** may, without prior notice, suspend MS4 discharge access to a person when such suspension is necessary to stop an actual or threatened discharge which presents or may present imminent and substantial danger to the environment, or to the health or welfare of persons, or to the MS4 or waters of the United States. If the violator fails to comply with a suspension order issued in an emergency, the **[authorized enforcement agency]** may take such steps as deemed necessary to prevent or minimize damage to the MS4 or waters of the United States, or to minimize danger to persons.

14.6.3. Suspension due to the Detection of Illicit Discharge

Any person discharging to the MS4 in violation of this ordinance may have their MS4 access terminated if such termination would abate or reduce an illicit discharge. The **[authorized enforcement agency]** will notify a violator of the proposed termination of its MS4 access. The violator may petition the **[authorized enforcement agency]** for a reconsideration and hearing.

A person commits an offense if the person reinstates MS4 access to premises terminated pursuant to this Section, without the prior approval of the **[authorized enforcement agency]**.

14.7. Civil Penalties.
In the event the alleged violator fails to take the remedial measures set forth in the notice of violation or otherwise fails to cure the violations described therein within **[___]** days, or such greater period as the **[authorized enforcement agency]** shall deem appropriate, after the **[authorized enforcement agency]** has taken one or more of the actions described above, the **[authorized enforcement agency]** may impose a penalty not to exceed $**[___]** (depending on the severity of the violation) for each day the violation remains unremedied after receipt of the notice of violation.

14.8. Criminal Prosecution.
Any person that has violated or continues to violate this ordinance shall be liable to criminal prosecution to the fullest extent of the law, and shall be subject to a criminal penalty of $**[___]** per violation per day and/or imprisonment for a period of time not to exceed **[___]** days. Each act of violation and each day upon which any violation shall occur shall constitute a separate offense.

SECTION 15. APPEAL OF NOTICE OF VIOLATION.

Any person receiving a Notice of Violation may appeal the determination of the **[authorized enforcement agency]**. The notice of appeal must be received within **[___]** days from the date of the Notice of Violation. Hearing on the appeal before the appropriate authority or his/her designee shall take place within **[___]** days from the date of receipt of the notice of appeal. The decision of the municipal authority or their designee shall be final.

SECTION 16. ENFORCEMENT MEASURES AFTER APPEAL.

If the violation has not been corrected pursuant to the requirements set forth in the Notice of Violation, or, in the event of an appeal, within **[___]** days of the decision of the municipal authority upholding the decision of the **[authorized enforcement agency]**, then representatives of the **[authorized enforcement agency]** shall 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 government agency or designated contractor to enter upon the premises for the purposes set forth above.

SECTION 17. COST OF ABATEMENT OF THE VIOLATION.

Within **[___]** days after abatement of the violation, the owner of the property will be notified of the cost of abatement, including administrative costs. The property owner may file a written protest objecting to the amount of the assessment within **[___]** days. If the amount due is not paid within a timely manner as determined by the decision of the municipal authority or by the expiration of the time in which to file an appeal, the charges shall become a special assessment against the property and shall constitute a lien on the property for the amount of the assessment.

Any person violating any of the provisions of this article shall become liable to the **[jurisdiction]** by reason of such violation. The liability shall be paid in not more than **[___]** equal payments.

Interest at the rate of **[___]** percent per annum shall be assessed on the balance beginning on the **[___]** day following discovery of the violation.

SECTION 18. 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 ordinance is a threat to public health, safety, and welfare, and is declared and deemed a nuisance, and may be summarily abated or restored at the violator's expense, and/or a civil action to abate, enjoin, or otherwise compel the cessation of such nuisance may be taken.

SECTION 19. REMEDIES NOT EXCLUSIVE.

The remedies listed in this ordinance 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.

The **[authorized enforcement agency]** may recover all attorney's fees court costs and other expenses associated with enforcement of this ordinance, including sampling and monitoring expenses.

SECTION 20. ADOPTION OF ORDINANCE.

This ordinance shall be in full force and effect **[___]** days after its final passage and adoption. All prior ordinances and parts of ordinances in conflict with this ordinance are hereby repealed.

PASSED AND ADOPTED this ____ day of _____, 20__, by the following vote:

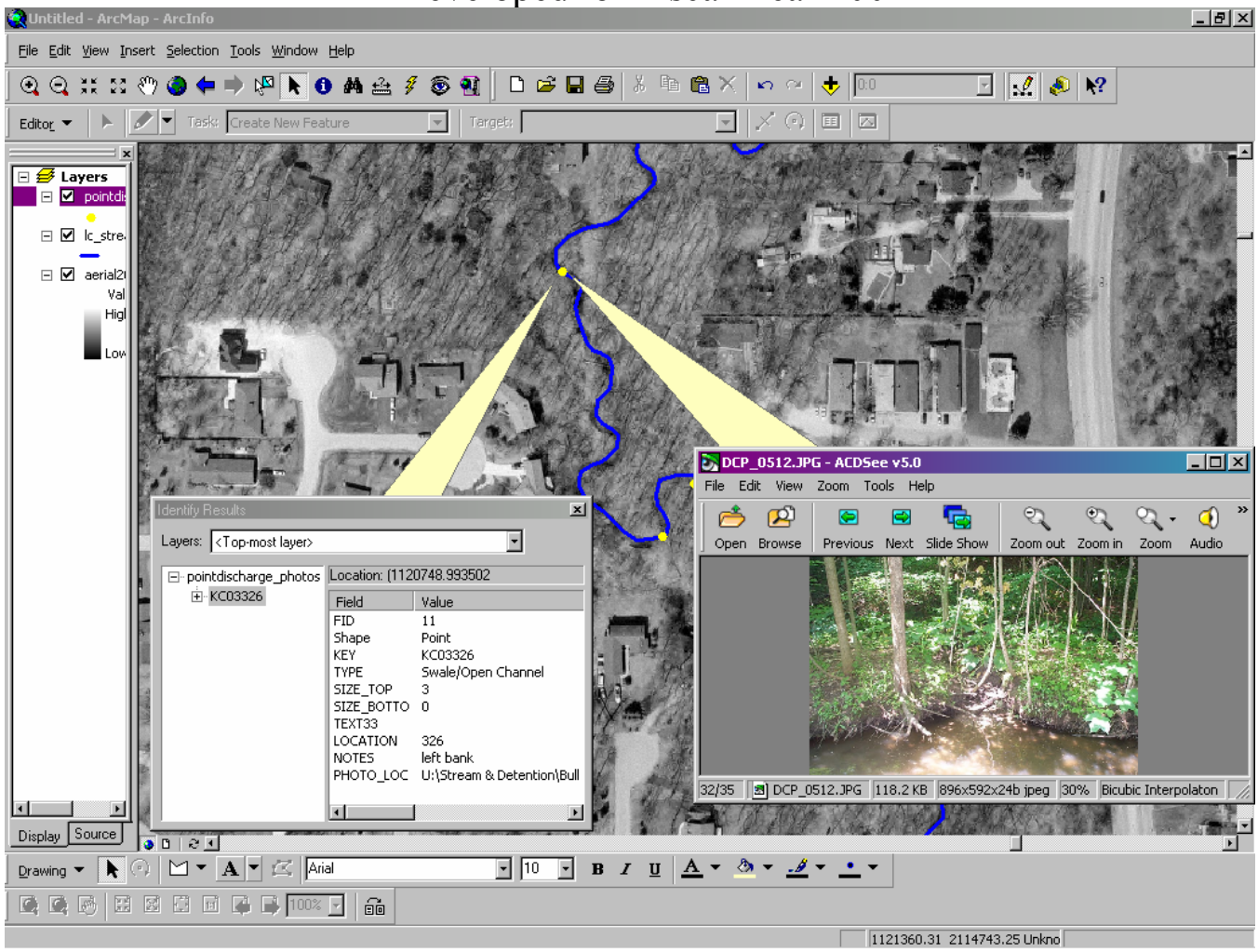
APPENDIX C

STORM SEWER OUTFALL INVENTORY RECOMMENDED COLLECTION GUIDENCE AND DATA DICTIONARY

Storm Sewer Outfall Inventory
Recommended Collection Guidance
And Data Dictionary

Our Goal: Successful Implementation of Illicit Discharge Detection & Elimination Program for NPDES Phase II Storm Water Permit

Developed for Fiscal Year 2004



LAKE COUNTY

STORMWATER MANAGEMENT COMMISSION

Program Purpose

Polluted storm water runoff is often transported to municipal separate storm sewer systems (MS4s) and ultimately discharged into local rivers and streams without treatment. Illicit discharges from MS4s often include wastes and wastewater from non-storm water sources that enter the storm sewer system through either direct or indirect connections. Federal regulations define an illicit discharge as "any discharge to an MS4 that is not composed of entirely storm water." Illicit discharges are considered "illicit" because MS4s are not designed to accept, process, or discharge such non-storm water wastes.

Recognizing the adverse effects illicit discharges can have on receiving waters, the final Phase II Storm Water rules require an operator of a regulated small MS4 to develop and implement an illicit discharge detection and elimination program. The objective of the illicit discharge detection and elimination minimum control measure is to have regulated small MS4 operators gain a thorough awareness of their systems. This awareness allows them to determine the types and sources of illicit discharges entering their system; and establish the legal, technical, and educational means needed to eliminate these discharges.

To implement a successful illicit discharge detection and elimination program, it is critical to develop an accurate and useable storm sewer system map which clearly indicates the location of all outfalls and the names and location of all receiving waters of the United States. **NOTE: This guidance will focus only on the collection of outfalls, which is the minimum required by the EPA. However, it is strongly recommended by the Lake County Stormwater Management Commission that communities locate all inlet locations as well as work towards the development of a map identifying the entire storm sewer network.** The storm sewer system map is meant to demonstrate a basic awareness of the discharge areas of the system. The map will be necessary to help determine the extent of discharged dry weather flows, the possible sources of the dry weather flows, and the particular water bodies these flows may be affecting. The EPA recommends collecting all existing storm sewer information on outfall locations (e.g., review city records, drainage maps, storm drain maps), and then conducting field surveys to verify the locations. The Lake County Stormwater Management Commission (LCSMC) would like to assist and offer guidance to communities required to collect storm sewer outfall locations. Therefore, the LCSMC has developed this *recommended* collection guidance and data dictionary which communities can use.

Program Goal

The goal of the Lake County Stormwater Management Commissions Stormwater Outfall Inventory is to assist communities in the development and implementation of a successful *Illicit Discharge Detection & Elimination Program* for their community, which is a requirement of the NPDES Phase II Storm Water Permit.

Measuring Success

The success of the Storm Sewer System Inventory will be measured by the number of illicit discharges to the storm sewer that are detected and the quality and usability of the system inventory map produced. The inventory must identify the outfalls and receiving streams within the jurisdictions. By manually collecting the storm drain outfall locations, communities can readily identify dry weather flow and other potential water quality problems. In addition, the completed storm sewer system inventory maps will be a valuable resource when responding to spills and other service requests in Lake County.

Lake County Stormwater Management Commission Strategy

The LCSMC met with several individuals experienced in GIS and data collection prior to drafting this "*Recommended Collection Guidance and Data Dictionary*" for the collection of storm sewer outfalls. During those discussions, it was determined that we would need to assist two types of communities; those with GIS capability and those without. It was discovered that, out of those communities with GIS capabilities, several were well under way in establishing storm sewer outfall maps to meet NPDES Phase II requirements and some communities with GIS capabilities and expertise have already met the requirements. For communities with GIS capabilities that have not produced an outfall map, we have included some recommendations/suggestions in Section I. Since the majority of communities in Lake County do not use or have access to GIS, we decided our main focus should be on those entities since they will require the most support and resources in order to produce an storm sewer outfall map meeting minimum EPA requirements. The recommended guidance for communities without GIS is in Section II

Definitions

The following are defined in the Statewide Permit which can be found at:
http://www.epa.state.il.us/water/permits/storm-water/general-ms4-permit.pdf

"***Outfall*** is defined at 40 CFR 122.26(b)(9) and means a point source as defined by 40 CFR 122.2 at the point where a municipal separate storm sewer discharges to waters of the United States and does not include open conveyances connecting two municipal storm sewers, or pipes, tunnels or other conveyances which connect segments of the same stream or other waters of the United States and are used to convey waters of the United States."

"***Point Source*** is defined at 40 CFR 122.2 and means any discernable, confined and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural storm water runoff."

"***Discharge***, when used without a qualifier, refers to discharge of a pollutant as defined at 40 CFR 122.2."

What kind of information needs to be collected for the outfall map?

Communities are required to have an inventory of all storm sewer outfalls (discharge points) which discharge into "Waters of the US" or any water body (i.e. receiving streams or lakes) which flow into "Waters of the US". Generally speaking, all waters in Lake County are considered "Waters of the US". There are some exceptions to this, for example, isolated wetlands by definition are not considered "Waters of the US" and there are a few inland lakes in Lake County that are not "Waters of the US".

Storm Sewer outfall types that communities need to collect include storm sewer pipes, culverts, swales and even sump pump discharges that collect and can release flow into lakes, rivers, and streams. Information about each outfall should be collected as well and we have made an attempt at compiling the most common and relevant types of information in our data dictionary.

What kind of information *DOES NOT* need to be collected for the outfall map?

Part I.B.2. "This permit authorizes the following non-storm water discharges provided they have been determined not to be substantial contributors of pollutants to a particular small MS4 applying for coverage under this permit:
* water line and fire hydrant flushing,
* landscape irrigation water,
* rising ground waters,
* ground water infiltration,
* pumped ground water,
* discharges from potable water sources,
* foundation drains,
* air conditioning condensate,
* irrigation water, (except for wastewater irrigation),
* springs,
* water from crawl space pumps,
* footing drains,
* storm sewer cleaning water,
* water from individual residential car washing,
* routine external building washdown which does not use detergents,
* flows from riparian habitats and wetlands,
* dechlorinated pH neutral swimming pool discharges,
* residual street wash water,
* discharges or flows from fire fighting activities
* dechlorinated water reservoir discharges, and
* pavement washwaters where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed)."

NOTE: It is clear that sump pump discharges from foundations are permitted, therefore, information need not be collected on them. However, sump pump discharges from inside the building are not permitted. Therefore, it is recommend that communities collect data on all sump pump discharges.

IMPORTANT: Assigning a Unique Identifier to the individual Outfalls

The assignment of a unique identifier (Outfall ID on the database form) for each outfall location is important and should be given careful thought before collection starts. Communities need to develop a system in which all inventoried outfalls have a unique identifier that can be used to link the outfalls to the required future dry weather screening inspection reports and other documentation (including photos) if applicable for each structure, whether a database or paper copies of the inspection reports are kept. The data dictionary suggests one possible method whereas a numbering system (either numeric or alpha-numeric) is used. When using a numbering system it is also recommended that communities number in increments of 10 in the event other missed or additional outfalls falling in between need to be added later. If the collected data is incorporated into a county-wide outfall map, the combination of the Outfall ID, Community ID, and Receiving Water (stream name) will differentiate the individual outfalls throughout the county.

Acknowledgements:

The Lake County Stormwater Management Commission would like to thank the Mecklenburg County (North Carolina) Water Quality Program for the use of the ArcPad™ screenshots and associated text in Section 1.

The Lake County Stormwater Management Commission would also like to thank Jennifer Hughes, Village Engineer for the Village of Lincolnshire, IL, for her valuable input and thorough review of this document.

SECTION I
RECOMMENDED GUIDANCE FOR COMMUNITES WITH GIS

Suggested Equipment

Keep in mind the following are suggestions only. Other collection methodologies may include equipment such as record drawings and aerial photographs, along with field mark-ups to locate storm sewer outfalls.

The suggested equipment that will be used to perform the storm sewer inventory for communities with GIS capabilities includes:

1. Compaq iPaq Pocket PC (or compatible)
2. ArcPad™ Software
3. ArcPad™ Application Builder (to design custom menus based on data dictionary)
4. Trimble GPS Unit
5. Trimble GPS Correct Software

In addition, the following materials are recommended for field use.

6. Tape measure
7. Camera
8. Cutting tools to remove debris
9. Sewer hook to open covers
10. Other field gear, as necessary

Note: Refer to reference manuals for detailed information about the equipment and software to be used for the storm sewer system inventory.

Recommended Data Collection Procedures

1. Load the Lake County Aerial Photography into handheld computers

The aerial photography will be used in the field to obtain a basic understanding of the watershed and the extent of development. The aerial photography will also be used to verify storm drain inlet and outfall locations.

NOTE: It is recommended that communities in Lake County with GIS capabilities enter into a data sharing agreement with the Lake County Department of Information and Technology, GIS and Mapping Division.

2. Set-up Equipment for Data Collection

After the aerial photography has been loaded, the GPS unit is then connected to the handheld computer. The GPS unit will assign fixed locations to the storm sewer system data that is collected in the field using the downloaded aerial photography on the handheld computer.

3. Collect Storm Sewer System Data

After the handheld computer and GPS unit are properly connected, then the storm sewer system data can be collected.

1. Turn on handheld computer.

2. After the handheld computer is turned on, open the ArcPad™ Software (**Figure 1**).

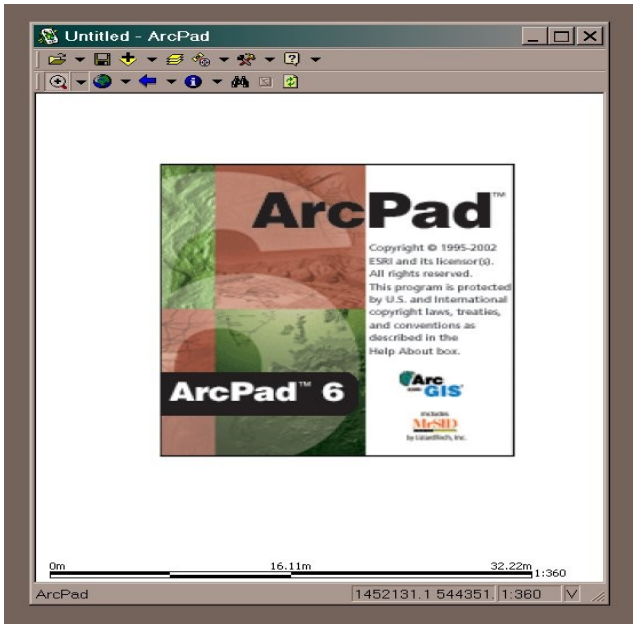


Figure 1: Open ArcPad™ Software

3. After accessing ArcPad™ software, then open existing ArcPad™ map (**Figure 2**). The ArcPad™ map will be the aerial photography, which has been loaded into the handheld computer.

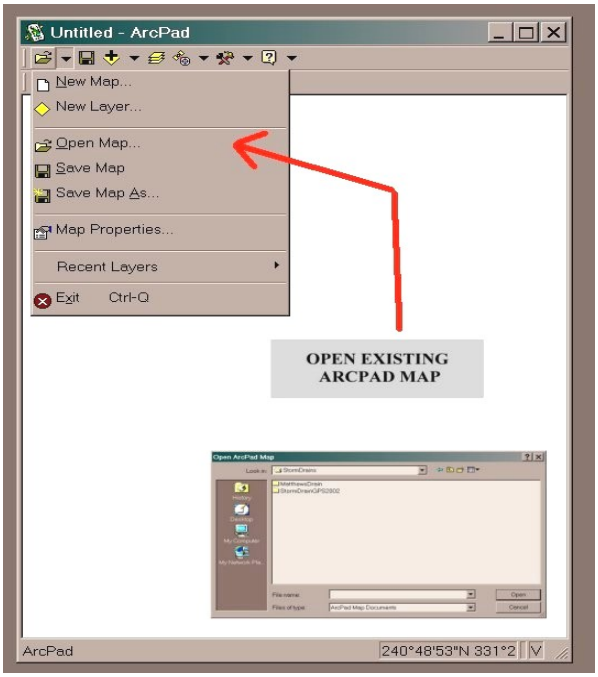


Figure 2: Open Existing ArcPad™ Map

4. After the aerial photography map is opened in ArcPad™, activate the GPS receiver (**Figure 3**).

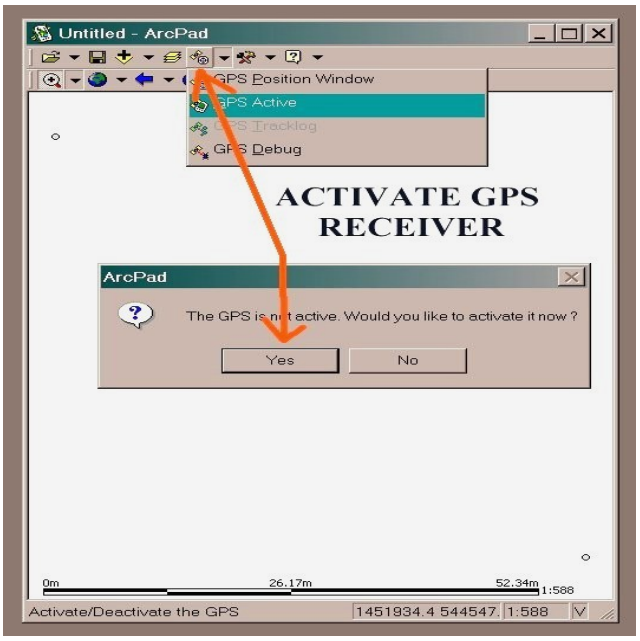


Figure 3: Activate GPS Receiver

5. Once the GPS receiver is activated, collect GPS point location (**Figure 4**). For accuracy, it is important to locate the GPS unit as close to the storm outfall as possible, when collecting the data. It may take a couple of minutes for the GPS receiver to lock in on the coordinates, pending signal strength.

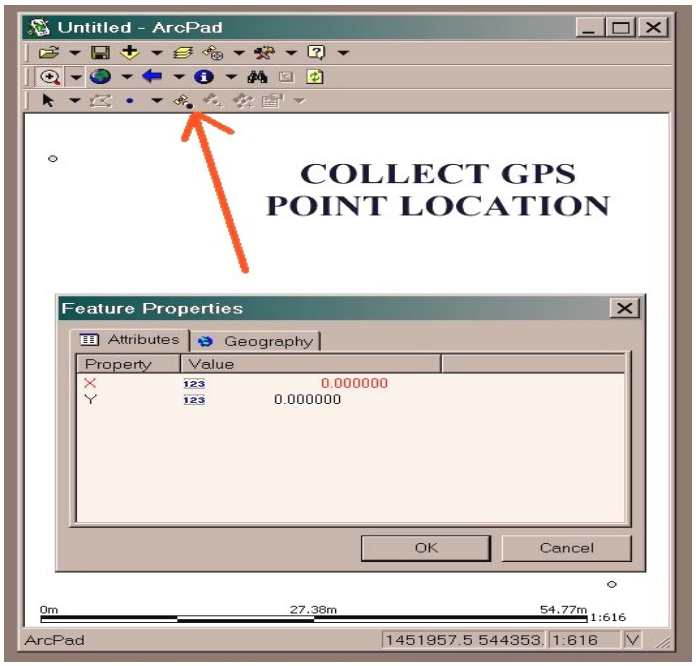


Figure 4: Collect GPS Point Location in ArcPad™

6. After the GPS location is collected, enter storm sewer system data into ArcPad™ (**Figure 10**).

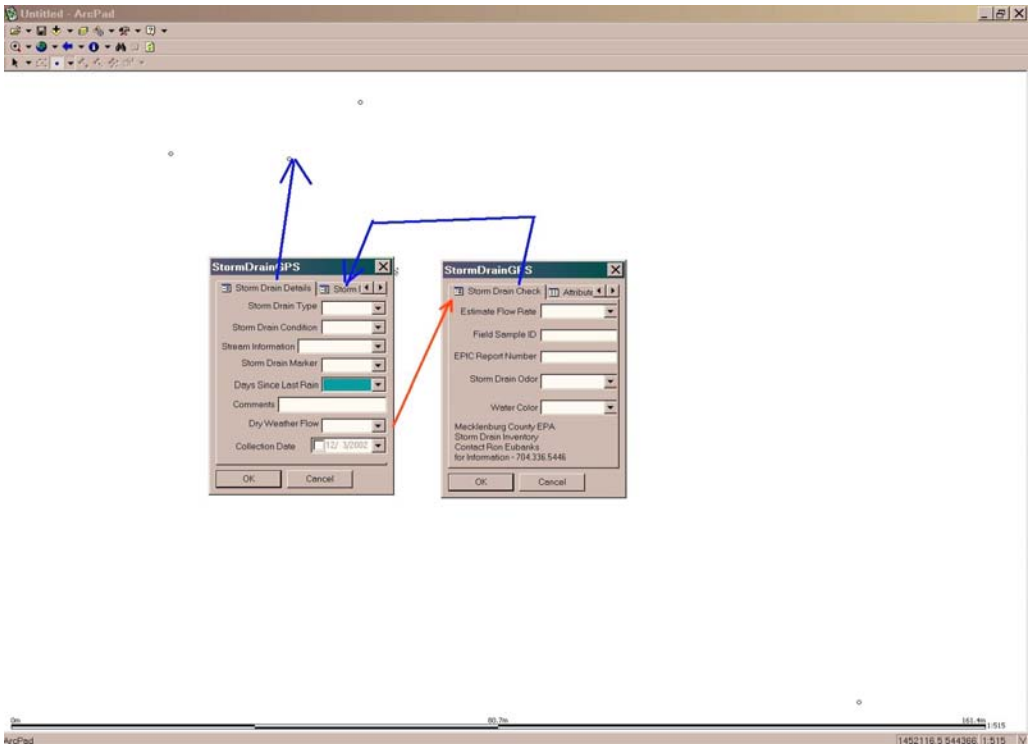


Figure 10: Storm Sewer System Data Collection

Entering storm sewer outfall data consistent with the data dictionary can be facilitated by developing custom menus with ArcPad™

Another recommendation would be to take digital pictures of the outfall locations you inventory. It will be necessary to correlate the digital photos to the GPS points so you can easily link them up in a relational database at a later date. One recommendation might be to record the photo number on a data collection form for that particular outfall. These standard collection forms can be obtained from the Lake County Stormwater Management Commission.

7. When performing the storm sewer system inventory, try to be as consistent and thorough as possible. Try to collect all information represented in the data dictionary. In the comments section, note any unusual problems with the storm drain outfalls (i.e., debris, blockages, etc.)

4. Download Data from Handheld Computers

After the storm sewer system inventory has been completed for the subject area that has been loaded into the handheld computer, the data must be downloaded into project database.

5. Post Process the Data for Accuracy

After the storm sewer system data has been collected and downloaded into the project database, it will be post processed with GPS Correct Software by GIS staff to ensure accuracy. This process involves verifying that the GPS locations are in correct alignment with the aerial photography **(Figure 13**).

Figure 13: Post Processing GPS Locations

6. Save Storm Sewer System Inventory Maps and Data into Project Database

After the storm sewer inventory data has been post processed for accuracy, it will be saved into project database. After all outfall locations have been collected, you will have an outfall inventory meeting NPDES Phase II requirements. It is also recommended that eventually you collect the inlet locations as well which will assist in tracing wet flows in dry conditions.

Figure 14: Storm Sewer System Inventory Map

SECTION II

RECOMMENDED GUIDANCE FOR COMMUNITES WITHOUT GIS

The Lake County Stormwater Management Commission recognizes that the majority of the communities in Lake County that will be producing the map of the storm sewer outfall locations within their boundaries do not have GIS capabilities or GIS access. The following recommended guidance is tailored specifically for those communities that will be mapping storm sewer outfall locations by manually checking plans, conducting field checks, and entering data either on paper forms or into a database. For these communities, the Lake County Stormwater Management Commission recommends obtaining paper base maps of the receiving streams within their community. Two copies should be obtained. One copy should be used in the office to plan and coordinate collection and the other should be a field copy on which the locations can be plotted.

Base maps for specific areas can be obtained from a number of various sources. The Lake County Planning, Building, and Development Department has aerial prints available for a minimal cost. Visit http://www.co.lake.il.us/planning/support/aerial.asp for details. The Lake County Department of Information and Technology, GIS and Mapping Division sells the county-wide aerial photos on CD for $50 and the CD includes free viewing software. Lake County Stormwater can also supply paper maps on an as-need basis.

Another free software program that can be downloaded via the web is ArcExplorer™. This free stand alone program is a GIS viewing application which will allow the user to view GIS layers and even create basic maps for print.

Recommended Materials

The recommended material that will be used to perform the storm sewer inventory for communities without GIS include:

1. Paper Base maps (at least two copies, one for field and one for office)
2. Data collection form (supplied by Lake County Stormwater Management)
3. Data Dictionary (supplied by Lake County Stormwater Management)
4. ArcExplorer™ free software from www.esri.com
5. 2002 Aerials from Lake County GIS
6. Tape measure
7. Camera
8. Cutting tools to remove debris
9. Sewer hook to open covers
10. Other field gear as necessary

Recommended Data Collection Procedures

Gather all materials for data collection. Collect as many storm sewer outfall locations from plans as possible while in the office. Plot the known outfall locations on a paper base map and capture as much information represented in the data dictionary as possible using the data collection forms. To collect additional outfall locations not on the plans or to gather addition information about locations on plans, perform field checks.

Another recommendation would be to take digital pictures of the outfall locations you inventory. It will be necessary to correlate the digital photos to the collected outfalls so you can easily link them up at a later date. One recommendation might be to record the photo number on a data collection form for that particular outfall. These standard collection forms can be obtained from the Lake County Stormwater Management Commission.

When performing storm sewer system inventory, try to be as consistent and thorough as possible. Try to collect all information represented in the data dictionary. In the comments section, note any unusual problems with the storm drain outfalls (i.e., debris, blockages, etc.)

Once all outfalls are plotted on the map and all data forms completed, the Lake County Stormwater Management Commission will enter all the plotted locations into a GIS database. The Lake County Stormwater Management Commission will then supply maps and data tables back to the community for the communities to use. The Lake County Stormwater Management Commission will not be responsible for the upkeep and maintenance of the GIS; however, if communities update the outfall maps the Lake County Stormwater Management Commission will update the GIS when notified by the community.

If communities request the Lake County Stormwater Management Commission to compile data into a GIS, The Lake County Stormwater Management Commission will not lay claim or be the owners of the data nor will the LCSMC police communities which have not collected information or maintained their maps. The LCSMC will simply act as a "holding pen" for data received from communities. The communities will lay claim to all said outfall data. If the LCSMC is contacted by third parties about the data, the LCSMC will direct all inquiries about the data to the community

Storm Sewer Outfall Inventory
Data Dictionary

These are the recommended minimum pieces of information communities should collect during the storm sewer outfall inventory and correspond to the fields on the data form.

1) **Community ID**

001 Antioch, Village of
002 Bannockburn, Village of
003 Barrington, Village of
004 Barrington Hills, Village of
005 Beach Park, Village of
006 Buffalo Grove, Village of
007 Deer Park, Village of
008 Deerfield, Village of
009 Fox Lake, Village of
010 Fox River Grove, Village of
011 Grayslake, Village of
012 Green Oaks, Village of
013 Gurnee, Village of
014 Hainesville, Village of
015 Hawthorn Woods, Village of
016 Highland Park, City of
017 Highwood, City of
018 Indian Creek, Village of
019 Island Lake , Village of
020 Kildeer, Village of
021 Lake Barrington, Village of
022 Lake Bluff, Village of
023 Lake Forest, City of
024 Lake Villa, Village of
025 Lake Zurich, Village of
026 Lakemoor, Village of
027 Libertyville, Village of
028 Lincolnshire, Village of
029 Lindenhurst, Village of
030 Long Grove, Village of
031 Mettawa, Village of
032 Mundelein, Village of
033 North Barrington, Village of
034 North Chicago, City of
035 Old Mill Creek, Village of
036 Park City, City of
037 Port Barrington, Village of
038 Riverwoods, Village of
039 Round Lake, Village of
040 Round Lake Beach, Village of
041 Round Lake Heights, Village of
042 Round Lake Park, Village of
043 Third Lake, Village of
044 Tower Lakes, Village of
045 Vernon Hills, Village of
046 Volo, Village of

047 Wadsworth, Village of
048 Wauconda, Village of
049 Waukegan, City of
050 Wheeling, Village of
051 Winthrop Harbor, Village of
052 Zion, City of
053 Antioch, Township of
054 Avon, Township of
055 Benton, Township of
056 Cuba, Township of
057 Ela, Township of
058 Fremont, Township of
059 Grant, Township of
060 Lake Villa, Township of
061 Libertyville, Township of
062 Moraine, Township of
063 Newport, Township of
064 Shields, Township of
065 Vernon, Township of
066 Warren, Township of
067 Wauconda, Township of
068 Waukegan, Township of
069 West Deerfield, Township of
070 Zion, Township of
071 Lake, County of

2. Receiving Water

This will be the name of the receiving water body (i.e. Squaw Creek, Mill Creek, Round Lake, etc.). If the name is unknown use UNK. For several UNK receiving waters, use UNK1, UNK2, etc.

3. Outfall ID

This will be a unique number assigned to an outfall. It is recommended communities start at 00001 and work up in increments of 10 in the event others need to be added in between.

4. Outlet type

01 Swale/Open Channel
02 Pipe or Culvert

5. Outlet material

01 Corrugated Metal
02 PVC
03 Reinforced Concrete
04 HDPE
05 Vitrified Clay
06 Ductile Iron
07 Brick lined
08 Asphalt (i.e. in the case of a paved open channel)
09 Natural/Earthen
20 Unknown
99 Not Applicable (i.e. in the case of a swale)

6. Outlet diameter

[value] this is the diameter of the pipe expressed in feet and decimal inches (i.e. 3ft 6in would be entered as 3.5, 3ft 9in as 3.75, etc)

99 not applicable (i.e. swale)

7. Outfall Source (Source of Data)

01 As-builts
02 Field checks
03 Design plans
04 NPDES Permit
05 Other (fill in comments)

8. Ownership (of outfall)

01 Public
02 Private
03 Industrial

9. Date of collection (required)

Collection date entered as MMDDYYY (i.e. MMDDYYY)

10. Collected by (required)

Initials of person collecting data – 2 or three characters

11. Photo Number

Photo number if applicable otherwise 0

12. Location (up to 250 characters)

Descriptive information about the location of the outfall.

13. Comments (up to 250 characters)
General comments about the outfall. If no comments, enter None

APPENDIX D

EQUIPMENT CHECKLIST

STORMWATER OUTFALL SCREENING EQUIPMENT CHECKLIST		
Field Analysis		Floats and Stopwatch
		pH Meter Kit (including Spare Battery)
		Chlorine Test Kit (Minimum of 15 tests)
		Copper Test Kit (Minimum of 15 Tests)
		Detergents Test Kit (Minimum of 15 Tests)
		Phenols Test Kit (Minimum of 15 Tests)
		Ammonia Test Kit (Minimum of 15 Tests)
		Color Chart
		Distilled Rinse Water (Minimum 1 Gallon)
		Wash Bottle with Distilled Water
		Wash Bottle with Tap Water
		Waste Ampoule Container
Sampling		Extended Sampler
		1-liter Polyethylene Pitcher (sample containers)
		Graduated Bucket and Rope
		Liquid Waste Disposal Container (Wide-Mouthed)
Other		Outfall Screening Data Form (Minimum of 10)
		Chain of Custody Forms for Lab Samples
		Clipboard and Pens
		Resident Form Letters (Minimum of 10)
		Training Manual
		Storm Sewer Maps
		Automatic Cameras (2 Rolls of Film)
		Flashlight
		Manhole Cover Hook
		Tape Measure
		Folding Rule
		Brush Clearing Tool
		5-Gallon Container of Tap Water
		Plastic Trash Bags
		Paper Towels
Safety		Traffic Cones/Flags/Flares
		Traffic Safety Vest
		First Aid Kit
		Safety Glasses/Goggles
		Insect Repellant
Personal		Rubber Boots
		Disposable Gloves (Latex)
		Insect Repellant
		ID Badge
		Sunscreen
		Steel-Toe Boots
		Work Gloves

APPENDIX E

STORMWATER OUTFALL SCREENING DATA FORM

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:	
Latitude:	Longitude:	GPS Unit:	GPS LMK #:
Camera:		Photo #s:	

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

- ☐ Industrial
- ☐ Ultra-Urban Residential
- ☐ Suburban Residential
- ☐ Commercial
- ☐ Open Space
- ☐ Institutional
- Other: _____
- 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 F

PROCEDURES FOR CALCULATING STORMWATER OUTFALL FLOW RATES

FLOW MEASUREMENT PROCEDURES FOR DRY WEATHER STORMWATER OUTFALL SCREENING

GENERAL INFORMATION

The USEPA NPDES stormwater regulations require only a description of dry-weather flow rates. A strict interpretation of this requirement would mean that only a qualitative description (for example, trickle or *moderate flow*) would need to be provided for the permit application. However, rough estimates of dry-weather flow also will be obtained for outfalls and screening points where the required data can be readily obtained. Estimates of flow discharge will be useful for screening base flow versus storm runoff pollutant loading potentials. With dry-weather flow information, it will be possible to address whether dry-weather loads cause any more than localized problems.

It is important to note that the dry-weather flow measurements will be rough estimates and are not intended to be precise measurements. This is consistent with other aspects of the dry-weather outfall-screening program that is intended to serve as an *Indicator* of pollution as opposed to determining quantitative results. For example, USEPA has approved the use of semi-quantitative field test kits rather than standard laboratory methods for analyses of pollutant parameters. Field crews should make an initial assessment regarding the level of effort required to estimate flows. If flow measurements will require more than about 10 to 15 minutes to obtain, a description of flow should be provided or an alternate sampling point should be identified. In no case should flow estimates become the primary focus of the dry-weather outfall screening activities. In general, flow measurements should be conducted only after a water quality grab sample has been collected, to avoid disturbing bottom sediments.

It will be the responsibility of the field crews to ensure that field measurements are as complete and as accurate as possible. Measurements should be recorded on the outfall screening data form. It will also be the responsibility of the field crews to ensure that field measurements are correctly transmitted to office staff designated to calculate flows and that any "special case" are accounted for. Field crews should become familiar with the relative magnitude of a given discharge rate and should review flow rates calculated in the office to check the reasonableness of the flow estimates.

Four methods are outlined for estimating dry-weather flow rates from outfalls and/or field screening points.

1. The easiest and most accurate method involves the use of a calibrated container that can be placed under the discharge point. This method is typically limited to locations where there is "free fall" under the discharge point. The "free fall" must be high enough and concentrated along a narrow area so that a calibrated container can be positioned to collect all of the flow or a known fraction of the flow.

2. The second method of estimating flow requires channel measurements. The cross-sectional area of the outfall and velocity must be estimated. The channel measurements can be accurately measured for pipes of a known diameter. However, open-channel measurements will generally rely on estimates of a top and bottom width. Velocity measurements will be

obtained using floats and a stopwatch. Channel pipe flow calculations will be derived in the office by designated staff.

3. The third method provided only for informational purposes, involves calculating flow based upon Manning's equation. This method is only appropriate for gravity flow in open channels where no backwater conditions are present. The Manning equation method will require additional estimates of channel/pipe characteristics including slope and roughness coefficients. Photographs of the cross section may be useful for refining these estimates.

4. A fourth method can be used if data for the previously discussed methods cannot be obtained: this method consists of using an assumed flow rate of 1 foot per second. For all methods, it is assumed that actual flow rates will be calculated in the office-after flow, data have been collected. The fourth method is essentially a variation of method two, with an assumed flow rate of 1 foot per second being used. The remainder of the method is the same as method two.

FREE-FALL FLOW MEASUREMENTS

The following procedure should be used to estimate dry-weather flow rates for locations characterized by free falling flow:

Equipment Needed:

- Bucket (2.5-gallon) graduated in one-pint increments, and
- Stop watch

Procedure:

1. Place container under flow discharge point so that entire flow is collected.

2. Time the flow for 1 minute or until the container overflows.

3. Repeat Steps 1 and 2 at least once, repeat twice if initial results are more than about 10 to 20 percent apart. Calculate the average time, dropping any outlier measurements.

4. Compute the flow rate as follows (to be conducted in the office):

$Q = V/t$

Where:

- Q = flow rate (gallons per minute),
- V=volume)gallons), and
- T=time required (minutes).

5. Convert the flow rate from gpm to cfs by multiplying by 0.0022. Record one significant figure only (for example, 0.1 cfs, 2.3 cfs, or 12 cfs).

Special Cases:

a. If the flow does not overfill the container in one minute:

   1. Collect flow for exactly one minute.
   2. Estimate the gallons or fractions.
   3. Report flow in gpm.

b. If the flow overfills the container in one minute:

   1. Collect flow for 30 seconds and multiply by 2 to calculate gpm.
   2. If necessary, collect flow for shorter intervals and multiply by the conversion factor to calculate flow in gpm:

Collection Time	Multiply By
15 sec	4
10 sec	6
5	12

CHANNEL/PIPE-VELOCITY MEASUREMENTS

The following method should be used to estimate flows in pipes or channels where a discernible velocity is observed and cross-sectional measurements can be readily obtained.

Equipment Needed:

- Depth measurement rod,
- Tape measure,
- Floats (floats can include corks, fishing bobbers, wooden sticks, or popcorn. If the float is not recoverable, then only objects that will be non-objectionable in receiving waters should be used), and
- Stopwatch

Procedures:

1. Locate a relatively uniform section of the channel/pipe between 3 to 10 feet long.

2. Mark off a known length of the channel/pipe using available objects such as rocks or sticks. If the outfall location is at the end of a pipe and the outfall is accessible, a yardstick can be placed into the pipe.

3. Use a stopwatch to measure the time required in seconds for a float to travel the marked-off distance. If conditions are windy, it is desirable to have a float that is partially submerged. The float can be inserted upstream and timed as it passes the starting point.

4. Step 3 should be repeated at least twice. If the velocity measurements vary by more than 10 to 20 percent, a third measurement should be obtained. The measurements should be averaged after dropping any outliers.

5. Measurements to calculate the cross-sectional area of the discharge should be obtained using a tape measure and/or depth measurement rod. These measurements will typically include depth of flow, pipe diameter and shape, channel top width, and channel bottom width.

   Depth of Flow:

   For pipe outfalls, depth should be measured at the deepest point. For channel outfalls, an average or typical depth should be measured. If necessary, measure at several points and calculate an average value.

   Pipe dimensions should be measured and recorded. Pipe shape should be recorded as either circular, elliptical, or arch.

   Channel Top Width:

   The distance across the flow surface channel at the point at which velocity measurements are measured using a tape measure.

   Channel Bottom Width:

   The channel bottom width should be measured directly or estimated by assuming side slopes. This may require wading into the channel. ***If wading is required, this should not be undertaken until after a water quality grab sample is collected to avoid disturbing bottom sediments.*** Rubber boots should be worn when wading in streams. If the channel is inaccessible for wading, adequate measurements may be collected from above (for example, by standing on top of a box culvert).

6. Compute the flow rate as follows (to be conducted in the office):

   Calculate the cross-sectional area (A) as follows:

   Rectangular Channel: $A=W \times D$
   Trapezoidal Channel: $A=(Wt + Wb)/2 \times D$

where:

W = channel width,
Wt = top width (at flow surface),
Wb= bottom width (at channel bottom), and
D= depth of flow.

Pipes: Use charts to determine area of flow based on pipe diameter, pipe shape, and depth of flow (Figure 1 provides data for circular pipes).

7. Calculate the flow using the continuity equation:

Q=A x V

where:

A= cross-sectional area, and
V=average velocity.

Special Cases:

Irregular Channels:

This method will be reasonably accurate (within about 25 percent) where very uniform tranquil flows occur in smooth channels or pipes. If flows are turbulent or the cross section is irregular, the accuracy of this method will be poor. Special cases such as rocks or other large impediments in the channel should be noted. Field crews will be required to make a judgment call whether actual conditions at a particular site warrant flow discharge measurements.

Manhole/Catch Basins:

Very rough flow estimates can be obtained from on top of a manhole or catch basin. A yardstick can be lowered to the channel floor or clamped to the sample collection rod and held just above the water surface. A brightly colored biodegradable floating object such as a piece of popcorn should be tossed upstream of the yardstick. A stopwatch can be used to measure the time required for the object to travel 3 feet. Several measurements should be made. Depth of flow can be estimated using the depth measurement rod. If the rod is unreadable from above, the rod can be wetted and covered with chalk or sand. The level to which the chalk or sand is washed off can be read after the rod is immersed into the flow stream.

MANNING EQUATION

The Manning equation can be used under certain circumstances to provide an estimate of flow rate without velocity measurements. The Manning equation requires only

Insert Figure 1

Cross-sectional Areas for Circular Pipes

measurements of the channel cross-section (area and radius) and slope. A Manning Roughness coefficient (n) must also be estimated for the channel. Many hydraulics texts provide guidance on selection of Manning's n. The Manning equation should only be used where the cross section of the channel or pipe is uniform, the slope and roughness of the channel can be estimated, and the gravity flow occurs (for example, no tidal conditions or backwater).

Equipment Needed:

- Depth measuring rod, and
- Tape measure.

Procedure:

1. Channel or pipe cross section measurements should be obtained as described previously.

2. Additional observations should include information to determine Manning's roughness coefficient. If possible, photographs should be taken of channel conditions.

3. Calculate flows using the Manning equation (to be conducted in the office). The Manning equations is as follows:

   $$Q=\frac{1.49(A)® \ 2/3S1/2}{N}$$

   where:

   Q= flow (cfs),
   n= Manning roughness coefficient,
   A=cross-sectional area (sq ft),
   R= hydraulic radius (ft), and
   S= slope of the hydraulic gradient.

If actual slopes are unknown, a minimum design slope of 0.5 feet per 100 feet can be used.

In certain cases, the Manning equation can be used as a quick check of the results from other flow estimation methods.

APPENDIX G

STORMWATER OUTFALL INSPECTION STANDARD OPERATING PROCEDURES

pH TEST
INSTRUCTIONS

CHEMetrics, Inc.

Range: 1 to 14

TEST PROCEDURE

1. Rinse the plastic beaker with sample material and fill to the 100 ml mark.
2. Remove the black protective cap from the meter.
3. Turn the meter on using the ON/OFF switch.
4. Dip in the sample up to the shoulder of the meter.
5. Stir gently and wait a few seconds for the digital reading to stabilize.
6. When the meter is not in use, switch off and replace the protective cap.

OPERATING NOTES

a) To condition the meter, soak the probe in tap water or pH7 buffer solution for at least 30 minutes prior to using it the first time. The meter should also be conditioned if it is not used for more than one week.

b) A dry electrode may result in widely fluctuating pH readings (±0.5 pH units). To improve performance leave the probe immersed in water (up to the shoulder) for a few minutes at least once a week.

c) Replace run-down batteries by removing the four screws on the rear housing. Insert four new 1.4-volt batteries. (Duracell MP 675 H or equivalent).

d) To calibrate the instrument, dip the probe in pH7 buffer solution. Allow the display to stabilize. Use the small key-shaped tool to turn the right trimmer and adjust the display to read 7.0, rinse the probe in distilled water, immerse the probe into either pH 4 or 10 buffer and allow the display to stabilize. Then adjust the left trimmer to read either pH 4 or 10.

Source: *CHEMetrics, Inc. 1994*

CHLORINE TEST KIT
INSTRUCTIONS

CHEMetrics, Inc.
Catalog Number K-2505

Range: 0-1 ppm and 1-5 ppm

SAFETY INFORMATION

Read Material Safety Data Sheet (MSDS) before performing this test procedure.

If this product is used as directed, the user will not come not contact with the reagent contained in these CHEMets®. If contact does occur, flush skin or eyes with water. Call a physician, if swallowed.

THE TEST METHOD

The K-2505 CHEMets® employ a methyl-substituted form of the well-known DPD (N, N-diethyl-p-phenylenediamine) reagent. This reagent develops a violet color that is proportional to the amount of free chlorine in the sample. Results are expressed in ppm (milligrams/liter) chlorine as $C1^2$.

Total chlorine, the sum of free and combined chlorine (i.e., chloramines), may be determined by adding potassium iodide (A-2500 Activator Solution) to the sample. Both free and combined chlorine react with the iodide to liberate iodine. The iodine then reacts with the reagent to give an accurate measurement of total chlorine.

Combined chlorine may be determined by subtracting the result for free chlorine from total chlorine:

Combined Chlorine=Total Chlorine-Free Chlorine

REFERENCE

Developed by CHEMetrics, Inc.

PRETREATMENT PROCEDURE

High levels of nitrite will interfere with both the free and total chlorine determinations. High levels of chloramines will interfere with the free chlorine determination. The following pretreatment procedure should not be used unless one or both of the above-mentioned interferences is strongly suspected.

1. Fill the sample cup to the 25 ml mark with your sample.

2. Add 14 drops of A-2501 Neutralizer Solution. Stir briefly and wait 10 to 15 seconds.

3. Proceed with the <u>free chlorine</u> test procedure using this pretreatment sample.

   Note: If chromate is present in the range of 2 to 15 ppm, subtract 0.3 from the final chlorine reading when using the pretreatment procedure.

TEST PROCEDURE

CAUTION

Do not break the tip of the ampoule unless it is completely immersed in your sample. Accidentally breaking the tip in the atmosphere may produce a "Jack-Hammer" effect, shattering the ampoule.

Wear eye protection when working with these ampoules.

Free Chlorine

1. Fill the sample cup to the 25 ml mark with your sample.

2. Place the CHEMet™ ampoule's tapered tip into one of the four depressions in the bottom of the sample cup. Snap the tip by squeezing the ampoule toward the side of the cup. The sample will fill the ampoule and begin to mix with the reagent.

   Note: A small bubble of inert gas will remain in the ampoule to facilitate mixing.

3. Remove the fluid-filled CHEMet™ ampoule from the cup. Mix the contents of the ampoule by inverting it several times, allowing the bubble to travel from end to end each time.

4. Wipe all liquid from the exterior of the ampoule and wait 1 minute.

5. After 1 minute, use the appropriate comparator to determine the level of chlorine in the sample.

Total Chlorine

1. Fill the sample cup to the 25 ml mark with your sample.

2. Add 5 drops of the A-2500 Activator Solution; stir briefly.

3. Proceed with the Free Chlorine Test Procedure using this pretreated sample.

USING THE COMPARATORS

Two comparators are included in the kit to cover the ranges 0 to 1 ppm (cylindrical) and 1 to 5 ppm (flat).

When using the lower range comparator, the CHEMet™ is placed in the center tube, flat end downward. The top of the cylinder is then directed toward a source of bright, white light while viewing from the bottom. Hold the comparator in a nearly horizontal position and rotate it until the color standard below the CHEMet™ shows the closest match.

The high-range comparator should be illuminated by a strong white light directly above the comparator. The filled CHEMet™ should be placed between the color standards for viewing. It is very important that the CHEMet™ by compared by placing it on both sides of the standard tube before concluding that it is darker, lighter, or equal to the standard.

Store the comparators in the dark when not in use.

SOURCES OF ERROR

Various free halogens (for example, bromine and iodine) and halogenating agents produce color with this reagent.

Source: CHEMetrics, Inc. 1994.

Insert “Material Safety Data Sheet”

Insert Material Safety Data Sheet Page 2

COPPER TEST KIT
INSTRUCTIONS

CHEMetrics, Inc.
Catalog Number K-3510

Range: 0-1 ppm and 1-10 ppm

SAFETY INFORMATION

Read Material Safety Data Sheet (MSDS) before performing this test procedure.

If this product is used as directed, the user will not come into contact with the reagent contained in these CHEMets®. If contact does occur, flush skin or eyes with water. Call a physician, if swallowed.

THE TEST METHOD

The K-3510 CHEMets® employ an acidic, buffered solution of bathocuproine in conjunction with a reducing agent. This reagent gives an orange – yellow color with samples containing copper solution. Suspended, insoluble particles of copper do not register in this test.

Results are expressed in ppm (milligrams/liter) as copper.

TEST PROCEDURE

1. Fill the sample cup to the 25 ml mark with your sample.

2. Place the CHEMet™ ampoule's tapered tip into one of the four depressions in the bottom of the sample cup. Snap the tip by squeezing the ampoule toward the side of the cup. The sample will fill the ampoule and begin to mix with the reagent.

   Note: A small bubble of inert gas will remain the ampoule to facilitate mixing.

3. Remove the fluid-filled CHEMet™ ampoule from the cup. Mix the contents of the ampoule by inverting it several times, allowing the bubble to travel from end to end each time.

4. Wipe all liquid from the exterior of the ampoule and wait 1 minute

5. After 1 minute, use the appropriate comparator to determine the level of copper in the sample.

USING THE COMPARATORS

Two comparators are included in the kit to cover the ranges 0 to 1 ppm (cylindrical) and 1 to 10 ppm (flat).

When using the lower range comparator, the CHEMet™ is placed in the center tube, flat end downward. The top of the cylinder is then directed toward a source of bright, white light while viewing from the bottom. Hold the comparator in a nearly horizontal position and rotate it until the color standard below the CHEMet™ shows the closest match.

The high-range comparator should be illuminated by a strong white light directly above the comparator. The filled CHEMet™ should be placed between the color standards for viewing. It is very important that the CHEMet™ be compared by placing it on both sides of the standard tube before concluding that it is darker, lighter, or equal to the standard.

Store the comparators in the dark when not in use.

SOURCES OF ERROR

Strong alkaline or buffered samples must be acidified with hydrochloric acid prior to test.

Various metals form colored compounds with the reagent and if present in high concentration may contribute to the apparent copper content of the sample.

Source: *CHEMetrics, Inc. 1994*

Insert Material Safety Data Sheet

PHENOLS TEST
KIT INSTRUCTIONS

CHEMetrics, Inc.
Catalog Number K-8012

Range 0.1-1 and 0-12 ppm

SAFETY INFORMATION

Read Material Safety Data Sheet (MSDS) before performing this test procedure.

If this product is used as directed, the user will not come into contact with the reagent contained in these CHEMets®. If contact does occur, flush skin or eyes with water. Call a physician, if swallowed.

TEST METHOD

The K-8012 CHEMets® are used to determine the concentration of Phenolic compounds in industrial wastewaters. The reagent, 4-aminoantipyrine in alkaline solution, gives a red color with samples containing phenols. The color forming reaction is initiated by potassium ferricyanide.

Since each phenolic compound has its own characteristic response to the reagent, test results are expressed in terms of "equivalent phenol". Most phenols produce less color with 4-aminoantipyrine than phenol itself, and most parasubstituted phenols do not respond at all.

When comparing results obtained by CHEMets® with those based on a procedure that includes steam distillation, it should be recognized that the latter will show only those phenols that can be volatilized by steam.

REFERENCES

APHA Standard Methods, 15th ed., p. 513, method 510C (1981).
ASTM Part 31 on Water, p.801, method 1783, part B (1981).
EPA Methods for Chemical Analysis of Waters and Wastes, p.420.2-1, method 420.2 (1979).

TEST PROCEDURE

1. Fill the sample cup to the 25 ml mark with your sample.

2. Dissolve the crystals on the tip of the CHEMet™ in the contents of the sample cup.

3. Place the CHEMet™ ampoule's tapered tip into one of the four depressions in the bottom of the sample cup. Snap the tip by squeezing the ampoule toward the side of the cup. The sample will fill the ampoule and begin to mix with the reagent.

   Note: A small bubble of inert gas will remain in the ampoule to facilitate mixing.

4. Remove the fluid-filled CHEMet™ ampoule from the cup. Mix the contents of the ampoule by inverting it several times, allowing the bubble to travel from end to end each time.

5. Wipe all liquid form the exterior of the ampoule and wait 1 minute.

6. After 1 minute, use the appropriate comparator to determine the level of "equivalent phenol" in the sample.

USING THE COMPARATORS

Two comparators are included in the kit to cover the ranges 0.1 to 1 ppm (cylindrical) and 1 to 12 ppm (flat).

When using the lower range comparator, the CHEMet™ is placed in the center tube, flat end downward. The top of the cylinder is then directed toward a source of bright, white light while viewing from the bottom. Hold the comparator in a nearly horizontal position and rotate it until the color standard below the CHEMet™ ampoule shows the closest match.

Note: If the CHEMet™ appears more yellow than the color standards, allow 5 to 10 minutes for color development.

The high range comparator should be illuminated by a strong, white light behind the translucent white backing. The filled CHEMet™ ampoule should be placed between the color standards for viewing. It is very important that the CHEMet™ ampoule be compared by placing it on both sides of the standard tube before concluding that it is darker, lighter, or equal to the standard.

Store the comparators in the dark when not in use.

SOURCES OF ERROR

Samples, which are strongly acidic, may overcome the buffering capacity of the reagent and produce low results. In case of doubt, the sample should be adjusted with alkali to a pH of 8-9.

Sulfide in excess of 100 ppm causes a yellow turbidity in the sample when the crystals are dissolved off the tip of the CHEMet™.

Ferrous iron may cause the sample to turn blue when the crystals are dissolved. For best results, these interferences should be removed prior to performing the test procedure.

Source: CHEMetrics, inc. 1994.

Insert Material Safety Data Sheet

Insert Material Data Sheet Page 2

DETERGENTS TEST
KIT INSTRUCTIONS

CHEMetrics, Inc.
Catalog Number K-9400

Range: 0-3 ppm

SAFETY INFORMATION

Read Material Safety Data Sheet (MSDS) before performing this test procedure.

If this produce is used as directed, the user will not come into contact with the reagent contained in these CHEMets®. If contact does occur, flush skin or eyes with water. Call a physician, if swallowed.

TEST METHOD

Anionic detergents react with methylene blue to form a colored complex that is extracting into an immiscible organic solvent (chloroform). The intensity of the resulting blue color in the solvent is directly related to the concentration of "methylene blue active substances (MBAS)" in the sample. Anionic detergents are among the most prominent of substances showing methylene blue activity.

Results of the test are expressed in ppm (milligrams/liter) linear alkyl benzene sulfonate (LAS-equivalent weight 325).

REFERENCES

APHA Standard Methods, 18th ed., p.5-36, method 5540C (1992).

TEST PROCEDURE

1. Rinse the reaction tube with sample and fill to the 5 ml mark.

2. While holding the double-tipped ampoule in a vertical position, snap the upper tip using the tip-breaking tool.

3. Invert the ampoule and position the open end over the reaction tube. Snap the upper tip and allow the contents of the ampoule to drain into the tube.

4. Cap the reaction tube and shake vigorously for 30 seconds. Allow the tube to stand undisturbed for one minute.

5. Make sure that the flexible tubing is firmly attached to the CHEMet™ ampoule tip.

6. Insert the CHEMet™ assembly (tubing first) into the reaction tube making sure that the end of the flexible tubing is at the bottom of the reaction. Break the tip of the CHEMet™ ampoule by gently pressing it against the side of the reaction tube.

7. When filling is complete, remove the CHEMet™ assembly from the reaction tube.

   Note: The CHEMet™ ampoule should draw in fluid only from the organic phase (bottom layer).

8. Invert the ampoule several times, allowing the bubble to travel end to end each time. Using a tissue, remove the flexible tubing from the CHEMet™ ampoule and wipe all liquid from the exterior of the ampoule.

9. Place a small white cap firmly onto the tip of the ampoule.

10. Use the comparator to determine the level of detergent in the sample.

USING THE COMPARATOR

The CHEMet™ ampoule is placed in the center tube, flat end downward. The top of the cylinder is then directed toward a source of bright, white light while viewing from the bottom. Hold the comparator in a nearly horizontal position and rotate it until the color standard below the CHEMet™ ampoule shows the closet match.

SOURCES OF ERROR

Negative interferences can result from the presence of cationic detergents.

Sulfides may reduce the methylene blue to a colorless form. Sulfide ions should be destroyed prior to performing the test procedure by adding hydrogen peroxide to the sample.

Source: CHEMetrics, Inc. 1994

Insert Material Data Sheet

Insert Material Data Sheet Page 2

AMMONIA-NITROGEN TEST KIT
INSTRUCTIONS

CHEMetrics, Inc.
Catalog Number K-1510

Range: 0.1-1 ppm and 1-10 ppm

SAFETY INFORMATION

Read Material Safety Data Sheet (MSDS) before performing this test procedure.

If this product is used as directed, the user will not come into contact with the reagent contained in these CHEMets®. If contact does occur, flush skin or eyes with water. Call a physician, if swallowed.

THE TEST METHOD

The K-1510 CHEMets® employ the Nessler's reagent, which is a highly alkaline solution of mercuric iodide. The Nessler's reagent develops a yellow color in the presence of ammonia.

The test kit is intended for application to samples where direct Nesslerization is feasible, that is where there is no need to separate the ammonia from interfering substances by distillation. Steam condensate and samples from most rivers, lakes, and streams are suitable for analysis by this technique.

Results of the test are expressed in ppm (milligrams/liter) as ammonia in nitrogen NH3-N.

REFERENCES

ASTM Part 31 on Water, p. 275, method D-1426, part B (1981).
APHA Standard Methods, 15th ed., p.351, method 417B (1980).
Developed by CHEMetrics, Inc.

TEST PROCEDURE

1. Fill the sample cup to the 25 ml mark with your sample.

2. Add 1 to 2 drops of A-1500 Stabilizer Solution.

3. Place the CHEMet™ ampoule's tapered tip into one of the four depressions in the bottom of the sample cup. Snap the tip by squeezing the ampoule toward the side of the cup. The sample will fill the ampoule and begin to mix wit the reagent.

   Note: A small bubble of inert gas will remain in the ampoule to facilitate mixing.

4. Remove the fluid-filled CHEMet™ ampoule fro the cup. Mix the contents of the ampoule by inverting it several times, allowing the bubble to travel from end to end each time.

5. Wipe all liquid from the exterior of the ampoule and wait 1 minute.

6. After 1 minute, use the appropriate comparator to determine the level of copper in the sample.

   Note: To convert to ppm (milligrams/liter) ammonia as NH3, simply multiply test results by 1.2.

USING THE COMPARATORS

Two comparators are included in the kit to cover the ranges 0.1 to 1 ppm (cylindrical) and 1 to 10 ppm (flat).

When using the lower range comparator, the CHEMet™ is placed in the center tube, flat end downward. The top of the cylinder is then directed toward a source of bright, white light while viewing from the bottom. Hold the comparator in a nearly horizontal position and rotate it until the color standard below the CHEMet™ shows the closest match.

The high-range comparator should be illuminated by a strong, white light directly above the comparator. The filled CHEMet™ should be placed between the color standards for viewing. It is very important that the CHEMet™ be compared by placing it on both sides of the standard tube before concluding that it is darker, lighter, or equal t the standard.

Store the comparators in the dark when not in use.

SOURCES OF ERROR

Samples that are strongly acidic or buffered may require neutralization prior to analysis.

Colored or turbid samples will cause error by obscuring the color of the solution in the CHEMet™ ampoule.

Various aromatic and aliphatic amines will react with this reagent.

Source: CHEMetrics, Inc. 1994.

Insert Material Safety Data Sheet

Insert Material Safety Data Sheet

APPENDIX H

STORMWATER OUTFALL SCREENING PROGRAM QUALITY ASSURANCE GUIDELINES

QUALITY ASSURANCE GUIDELINES
FOR STORMWATER OUTFALL SCREENING

These quality assurance guidelines define the quality assurance and quality control procedures to be used for the stormwater outfall-screening program. The objective of the program is to identify and remove inappropriate discharges to municipal storm sewer systems. The information generated from this program may be used to determine the need for additional monitoring and remediation activities; therefore, it is imperative that all outfall-screening activities strictly adhere to quality management protocols.

Quality control (QC) is a system of specific routine activities and procedures (for example, equipment calibration, duplicate sampling analysis, and equipment maintenance) that are designed and implemented to ensure that outfall screening data generated by a program are valid and usable.

Quality assurance (QA) is the system under which specific QC activities are incorporated. QA includes planning, assessing of screening performance (for example, through audits), and standardizing procedures for reporting and improving QC activities.

Because the outfall screening procedures for this program consist of qualitative assessments (visual and olfactory) and semi-qualitative analyses (field test kits), a full comprehensive quality assurance project plan has been determined to be unnecessary by the Illinois Environmental Protection Agency and the Lake County Stormwater Management Commission. The format and content of these guidelines were derived from applicable sections of the USEPA Region V document "Content Requirements for Quality Assurance Project Plants,")Document Number R5-QAS-93-001) and from previously implemented programs similar in scope to this program.

As previously stated, because there are no laboratory procedures associated with this program, many of the sections of the USEPA document are not applicable. The sections of the USEPA document that will be addressed in these quality assurance guidelines include the following:

- Quality Assurance Objectives for Measurement Data,
- Chain-of-Custody and Data Reporting, and
- Corrective Action.

QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

The parameters to be screened for in the outfall screening program fall into two categories: 1) descriptive screening parameters that consist of qualitative assessments by the observer of color, odor, turbidity, and presence of an oil sheen or surface sum and 2) screening parameters using semi-qualitative field test kits for pH, ammonia nitrogen, total chlorine, total copper, total phenol, and surfactants. Both categories of parameters will be screened for any outfall at which a dry-weather flow is observed.

The presence of any of these types of parameters will be cause to investigate further the possibility of inappropriate discharges to the storm sewer system.

The techniques for evaluating the presence and description of the parameters in the first category are highly subjective and will vary to some degree from person to person. Because of this, the typical quality assurance objectives of precision, accuracy, representativeness, and comparability are not measurable. Data completeness should be attained by providing proper training of field staff to ensure that SOPs and outfall screening instructions are followed. In order to maximize data quality and evaluate completeness, it is important to provide a complete description of all observations made in the field at the time of sampling through proper data form completion.

It is appropriate to evaluate precision, representativeness, and comparability for the category 2 parameters. As for the category 1 parameters, data completeness should be achieved by properly trained field personnel following the SOPs and outfall screening instructions in the program training manual and can be evaluate by reviewing the data reporting forms. Accuracy of the data is checked through the comparison of a measured value with a "known true" value, or standard. For those analyses where standards are available, the accuracy will be checked during periodic tests of the test kits and equipment. In addition, ensuring that equipment is properly cleaned after each use will help assure more accurate measurements.

Precision will be assessed by collecting and testing one duplicate outfall sample per day of outfall screening. A duplicate will be collected by collecting a sample in a large, clean container with sufficient volume for two full sets of analyses. The full set of tests should be run on the sample and then after properly cleaning the equipment, run on the duplicate. The duplicate should be recorded on a clearly marked data reporting form. It is recommended that field judgment be used to select the duplicate location where there is sufficient flow to easily fill a large container.

Representativeness will be assessed by collecting and testing one field blank per outfall screening season or when new field test kits are purchased. The field blank will be collected by pouring distilled water into a cleaned collection container and then analyzing portions of the sample for each parameter in the same way that samples are analyzed. The blank results should be recorded on a clearly marked data reporting form. A positive result for any of the parameters in the blank sample should be an indication of a problem that may render data unusable.

Additionally, representativeness of samples will be assessed by evaluating any non-conformance with the approved sampling and testing methods that are documented on the data reporting forms.

Comparability will be a function of personnel training and consistent use, maintenance, and calibration (where applicable) of recommended field test kits and equipment. It is recommended that as part of the training program, new field personnel be accompanied by an experienced field inspector to at least two outfall inspections to learn the proper use of the test kits, equipment, and data recording forms. As part of the training, and to evaluate comparability, field personnel should independently conduct field screening activities until two data reporting forms are consistent with the field inspector's forms.

CHAIN-OF-CUSTODY AND DATA REPORTING

All outfall-screening activities must be traceable through field records to the person(s) collecting the samples and to the specific pieces of sampling equipment (where appropriate) used to collect and test the sample. All data forms must have the initials of the field crews and should be signed by the field investigator. Signatures on the data form will imply that all information entered is accurate and complete to the best of the field investigator's knowledge. At the end of each day, it is imperative that completed data reporting forms be transmitted to the appropriate personnel for review and filing.

Before leaving each day for outfall inspections, field crews must ensure that all necessary equipment is operable and calibrated, where required. The maintenance and calibration activities for the equipment must also be documented and filed. Field test kits and equipment shall be assigned with an identification number, which should be recorded on the data recording forms and traceable to the maintenance and calibration records.

CORRECTIVE ACTION

As part of the quality assurance aspects of the program, it may be necessary to implement corrective actions for various problems that may become apparent after the program is underway. Problems may be identified through review of quality control checks, such as the use of field, duplicates and blanks, through equipment maintenance records, or through routine checks of field crew performance and data reporting form completion.

For equipment or field-test-kit related problems, it may be necessary to replace a particular field test kit or piece of equipment or even change manufacturers. Problems that appear to be related to the performance of field personnel may require some refresher training (preferably on-the-job) and/or closer observation by supervisory staff. An increased level of quality control samples could also be required. If it is determined that the quality of the field data is adversely affected by any of these problems, it should be noted on the data reporting forms and a decision should be made as to weather or not the data are usable or should be recollected (if possible).

These quality assurance guidelines should be reviewed and modified as necessary during the program and at the start of all major rounds of screening activities.

APPENDIX I

STORMWATER OUTFALL SCREENING STEPS

STORMWATER OUTFALL SCREENING STEPS

These instructions provide a reference for outfall screening activities only. It is assumed that program planning activities such as outfall scheduling and identification of outfalls and receiving waters will be conducted prior to outfall screening. In addition, it is assumed that municipal staff will be trained and will have read the training manual prior to conducting screening activities.

Step 1: **Review Outfall Screening Section of Stormwater Outfall Screening Program Training Manual**

The Outfall Screening section of the training manual (pages 18-30) describes all outfall screening activities – review this section at the start of outfall screening activities and as often as necessary while conducting outfall screening.

Step 2: **Obtain and Organize Outfall Screening Equipment**

An equipment checklist is provided in Appendix D of the Training Manual. Be certain that all equipment on the list has been obtained.

Remember that the training manual and storm sewer maps are required equipment items. Make sure that sufficient copies of the outfall screening data forms are included.

Step 3: **Conduct a Trial Run of Outfall Screening Procedures (At Initiation of Outfall Screening Activities and As Needed).**

Refer to the Outfall Screening section (pages 18-30) of the Training Manual and standard operating procedures for field test kits in Appendix E of the Training Manual.

Step 4: **Monitor Weather for Outfall Screening Window of Opportunity**

Make a determination based on information from radio or television whether stations or from rain gage, data whether the 72 hours prior to the scheduled inspection date have been dry.

If the 72 hours preceding the scheduled inspection date have been dry, then proceed with outfall screening activities; if not, wait for a 72-hour dry period before proceeding.

Step 5: **Check Schedule of Outfalls to be Screened**

A schedule of outfalls to be screened should have been prepared during the program-planning phase of the project. The schedule should show a schedule for outfall inspection. In addition, the schedule should show what outfalls have been screened and what outfalls require a second inspection

Based on review of the schedule, prepare a list of outfalls to be inspected for the day, remembering that outfalls requiring a second inspection should always be inspected before inspections of new outfalls. Based on local knowledge of the outfalls scheduled for screening, try to anticipate travel route, parking, access, or any other potential problems.

Step 6: **Conduct First Scheduled Outfall Inspection**

Visit scheduled outfall and access site. Be aware of site access, safety issues, and traffic impacts. If access is not practicable because of physical barriers or other constraints, or if the outfall is submerged, note the conditions in the "Remarks" section of the outfall screening data form and consider inspecting the outfall at a later date. Another possibility is to proceed upstream to a suitable screening location such as a manhole. If a suitable screening location cannot be easily found, proceed to the next scheduled outfall and address the problematic outfall in the office.

6.1 Record basic outfall data on Stormwater Outfall Screening Data Form (provided in Appendix E of the Training Manual) (refer to pages 21-26) of the Training Manual for data recording instructions).
6.2 Take photograph of outfall using date-stamp camera.
6.3 If flow is observed, conduct following tasks (if flow is not observed, fill out Stormwater outfall Screening Data Form and proceed to Step 7):
    6.3.1 Collect grab sample using 1-liter polyethylene container.
    6.3.2 Describe color (use color chart if color is present).
    6.3.3 Describe odor (refer to page 23 of the Training Manual).
    6.3.4 Describe turbidity (refer to page 23 of the Training Manual).
    6.3.5 Assess presence of floatables (refer to page 23 of the Training Manual).
    6.3.6 Conduct test kit analyses (refer to pages 24-26 and standard operating procedures in Appendix F of the Training Manual):
        - pH,
        - Copper,
        - Chlorine,
        - Phenol,
        - Detergents, and
        - Ammonia.

Dispose of all outfall samples for test kit analysis in a special container marked "Liquid Waste" for proper disposal to a sanitary sewer at end of day.

Collect and analyze a duplicate sample from the first outfall inspected each day of screening (refer to quality assurance guidelines in Appendix H of the Training Manual).

6.3.7 Rinse all sample collection and testing containers and dry; clean outfall screening work area-place all uncontaminated garbage in a bag for proper disposal at end of day.

6.3.8 Collect data for calculating flow rate (refer to Appendix F of the Training Manual for directions); depth, volume, and/or velocity measurements may be required.

6.3.9 Ensure that the Stormwater Outfall Screening Data Form has been completely filled out.

Step 7: Proceed to Remaining Outfalls Scheduled for Inspection
Repeat Steps 6.1,6.2, and 6.3, as appropriate.

Step 8: Return to Office; Conduct Daily Closeout Activities

8.1 Dispose of solid and liquid wastes.

8.2 Identify outfalls that require second inspections.

8.3 Update outfall-screening schedule.

8.4 File one copy of all Stormwater Outfall Screening Data Forms (pending development of photographs).

8.5 Plan next day's activities.