Outfall Screening/Monitoring

Wet Weather vs. Dry Weather

Southwest Pennsylvania Commission
Public Safety Training Center
Monroeville, PA
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Michael T. LaSala, CPMSM, CSI
Senior MS4 Program Manager/Analyst

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Introduction - Agenda

Introduction and Background (10-15 minutes)

Outfalls vs. discharge points (10-15 minutes)

Discharge parameter selection and sampling (30-40 minutes)

Primary IDD&E processes (25-35 minutes)

Wet weather/dry weather monitoring (15-20 minutes)

Quality Control (QC) considerations (10-15 minutes)

Documentation and assessments (15-20 minutes)

Program goal support/monitoring (10-15 minutes)

Discussion & Questions

Outfall Screening/Monitoring

Introduction & Background

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Clean Water Act (CWA)

- Primary federal law governing water pollution.

- Primary objective/purpose is to restore and maintain the **chemical, physical, and biological** integrity of the nation's waters by
  - Preventing point and nonpoint source pollution sources
  - Providing assistance to publicly-owned treatment works (WWTPs)
  - Maintain the integrity of wetlands

The primary pollution control strategy for point sources is the National Pollutant Discharge Elimination System (NPDES)

Clean Water Act (CWA)

Primary purpose of the CWA:

- Protect the beneficial uses of surface waters (recreational, drinking supply, habitat, etc.)…**Do not cause and/or contribute to an impairment of a receiving waterbody**.
- Purpose is carried out through NPDES Permits (e.g. MS4 Permit) that must adhere to specific requirements for water quality.

CWA Requirements for Water Quality Standards:

1. Designated Uses
2. Water Quality Criteria
3. Anti-degradation policy

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NPDES Permit – MS4

Any facility that discharges wastewater directly to surface water must obtain an NPDES Permit (from the USEPA or state) – such as an MS4

Requirements generally found in an MS4 Permit:

- Limitations (mostly narrative) on certain pollutants discharged via the MS4
  - **Why narrative?** Intent was to allow local conditions dictate numeric considerations
- Monitoring Requirements
- Reporting & Recordkeeping
  - "Pollution Prevention Programs"

An open system and discharge concerns need to be defined when considering the waterways use, WQ criteria, and anti-degradation.

Important regulatory and MS4 Permit language

Authorization to Discharge

- "2013 PAG-13" – Limitations on Coverage (part 2.j)
- "2018 PAG-13 (draft)" – Discharges Not Authorized (item 6)

"The discharge is not, or will not, result in compliance with an applicable effluent limitation or water quality standard."

The operator must, at a minimum, develop, implement, and enforce a SWMP designed to reduce the discharge of pollutants from the MS4:

- to the maximum extent practicable (MEP),
- to protect water quality, and
- to satisfy the appropriate water quality requirements of the Clean Water Act. [40 CFR 122.34(a)]

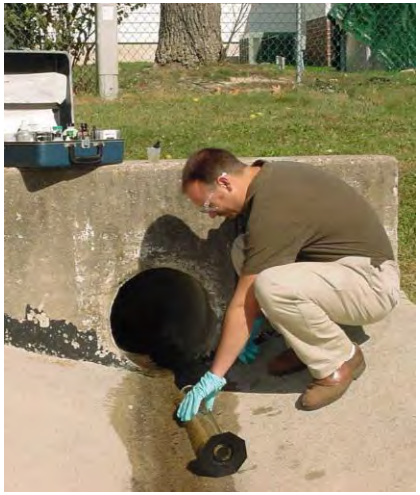
MS4 Permit Program (SWMP) – Management and Elements

Stormwater Management for Small MS4s…are the following addressed?

- Applicability
- Limitations on Coverage
- Discharges to Water Quality Impaired Waters
- Stormwater Management Program (SWMP)
- Public Education and Outreach (MCM 1)
- Public Involvement/Participation (MCM 2)
- Illicit Discharge Detection & Elimination (MCM 3)
- Construction Site Stormwater Runoff Control (MCM 4)
- Post-Construction Stormwater Management in New Development and Redevelopment (MCM 5)
- Pollution Prevention/Good Housekeeping for Municipal Operations (MCM 6)
- Sharing Responsibility
- Reviewing and Updating SWMPs
- Monitoring
- Recordkeeping
- Reporting

SWMP Elements – MCMs

- MCM 1: Public Education & Outreach
- MCM 2: Public Involvement & Participation
- MCM 3: Illicit Discharge Detection & Elimination (IDD&E)
- MCM 4: Construction Site Runoff Control
- MCM 5: Post-Construction SWM
- MCM 6: Good Housekeeping



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Do we generally tie and limit screening/ monitoring tasks to one of the MCM's?

Screening/Monitoring activities

Screening/monitoring activities directly and indirectly support the following Protocol aspects in bold font:

- Applicability
- **Limitations on Coverage**
- **Discharges to Water Quality Impaired Waters**
- **Stormwater Management Program (SWMP)**
- **Public Education and Outreach (MCM 1)**
- **Public Involvement/Participation (MCM 2)**
- **Illicit Discharge Detection & Elimination (MCM 3)**
- **Construction Site Stormwater Runoff Control (MCM 4)**
- **Post-Construction Stormwater Management in New Development and Redevelopment (MCM 5)**
- **Pollution Prevention/Good Housekeeping for Municipal Operations (MCM 6)**
- **Sharing Responsibility**
- **Reviewing and Updating SWMPs**
- **Monitoring**
- **Recordkeeping**
- **Reporting**

Illicit Discharge Detection & Elimination (MCM 3)

REGULATORY LANGUAGE:

(3) *Illicit discharge detection and elimination*.

(i) You must develop, implement and enforce a program to detect and eliminate illicit discharges (as defined at § 122.26(b)(2)) **INTO** your small MS4.

Illicit Discharge definition:

Illicit discharge means any discharge **TO** a municipal separate storm sewer that is not composed entirely of storm water except discharges pursuant to a NPDES permit (other than the NPDES permit for discharges from the municipal separate storm sewer) and discharges resulting from fire fighting activities.

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Illicit Discharge Detection & Elimination (MCM 3)

REGULATORY LANGUAGE cont'd:

(ii) You must:

(A) Develop, if not already completed, a storm sewer system map, showing the location of all outfalls and the names and location of all waters of the United States that receive discharges from those outfalls;

(B) To the extent allowable under State, Tribal or local law, effectively prohibit, through ordinance, or other regulatory mechanism, non-storm water discharges **INTO** your storm sewer system and implement appropriate enforcement procedures and actions;

(C) Develop and implement a plan to detect and address non-storm water discharges, including illegal dumping, **TO** your system; and

(D) Inform public employees, businesses, and the general public of hazards associated with illegal discharges and improper disposal of waste.

Illicit Discharge Detection & Elimination (MCM 3)

REGULATORY LANGUAGE cont'd:

(iii) You need address the following categories of non-storm water discharges **OR** flows (i.e., illicit discharges) only if you identify them as significant contributors of pollutants to your small MS4*:

- water line flushing,
- landscape irrigation,
- diverted stream flows,
- rising ground waters,
- uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20)),
- 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

*Discharges or flows from fire fighting activities are excluded from the effective prohibition against non-storm water and need only be addressed where they are identified as significant sources of pollutants to waters of the United States

Illicit Discharge Detection & Elimination (MCM 3)

REGULATORY LANGUAGE cont'd:

(iv) Guidance: EPA recommends that the plan to detect and address illicit discharges include the following four components:

- procedures for locating priority areas likely to have illicit discharges;
- procedures for tracing the source of an illicit discharge;
- procedures for removing the source of the discharge; and
- procedures for program evaluation and assessment.

EPA recommends visually screening outfalls during dry weather and conducting field tests of selected pollutants as part of the procedures for locating priority areas. Illicit discharge education actions may include storm drain stenciling, a program to promote, publicize, and facilitate public reporting of illicit connections or discharges, and distribution of outreach materials.

So what does all the legal jargon mean?

IDD&E Processes

- Processes and procedures associated with pollutants and **PRIOR TO** system entry.
- Processes and procedures associated with pollutants and **IN** the system.
- Processes and procedures associated with discharge (or **EXIT**) from the system.

Screening/monitoring applies to all three processes.

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Illicit Discharge Detection & Elimination (MCM 3)

EPA **recommends visually screening outfalls during dry weather** and conducting field tests of selected pollutants **as part** of the procedures for locating priority areas. Illicit discharge education actions may include storm drain stenciling, a program to promote, publicize, and facilitate public reporting of illicit connections or discharges, and distribution of outreach materials.

Checklist of items to address (processes and procedures)

- System Map
- Determining Priority Areas
- Enforcement Procedures & Actions (incl. ordinance)
- Detecting illicit discharges
- Tracing a source of an illicit discharge
- Removing a source of an illicit discharge
- Evaluation and assessment
- Education

Need a framework to work within to address the checklist and facilitate a compliant program.

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Outfalls vs. Discharge Points

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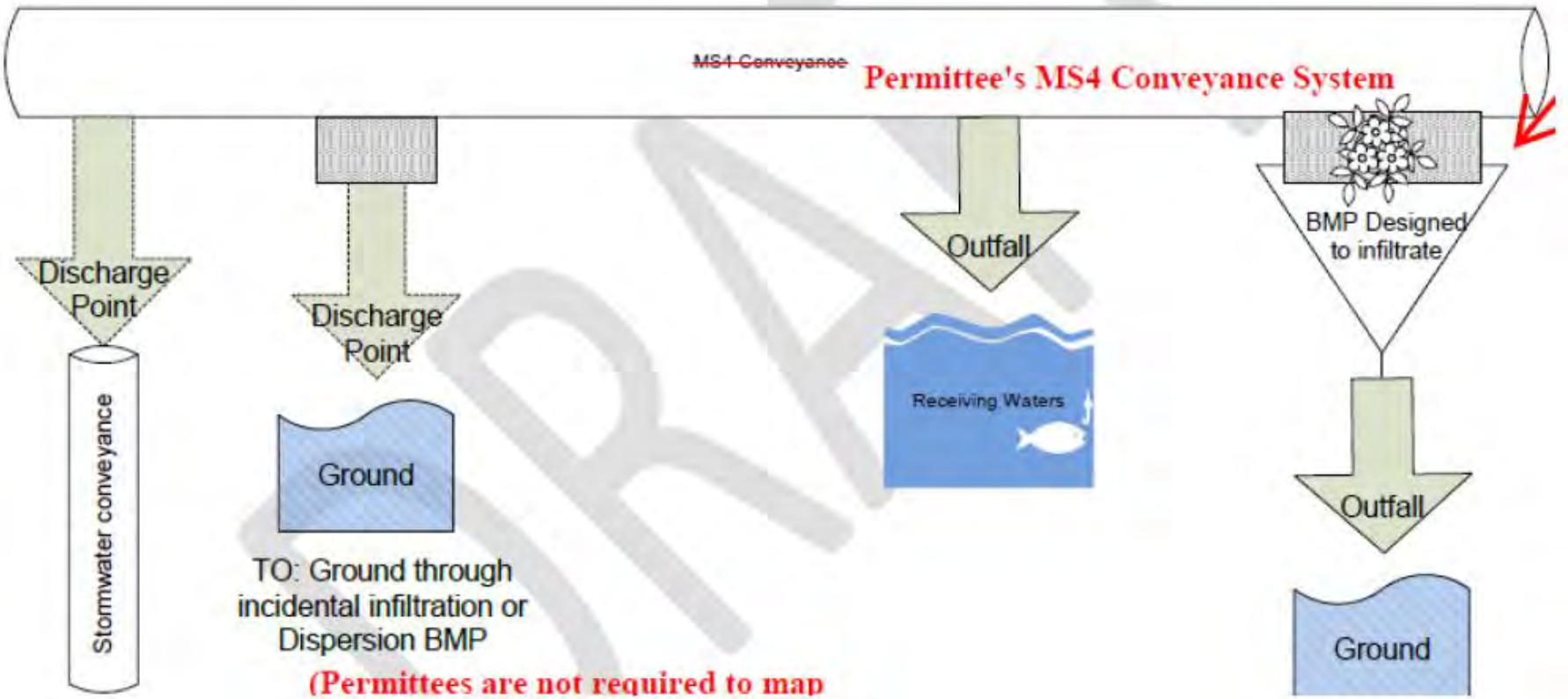
Outfall vs. Discharge Point



***Only where a "significant nexus" exists or meets "adjacent" criteria**

Outfall 101

*An **outfall** is the discharge point of a waste stream into a body of water*

WWTP Outfall

MS4 Outfall

Outfall 201 (for MS4 Permits)

The point where a conveyance or system of conveyances that disposes stormwater that are owned or operated by a municipality; and is **designed or used for collecting or conveying storm water** to a defined and discernible point from which pollutants are or may be discharged—and that discharges to waters of the United States is an ***Outfall.***

Outfall

Not an outfall

Outfall 301 (SWMP defined example)

The point where the regulated conveyance or system of conveyances that disposes stormwater that are owned or operated by the borough; and is designed or used for collecting or conveying storm water to a defined and discernible point owned and operated by the borough from which pollutants are or may be discharged—and that discharges to Waters of the United States/Surface Waters of the Commonwealth of Pennsylvania is an MS4 Outfall.

Don’t forget “other” outfalls that are applicable

ITEM	SYMBOL	CODE	DESCRIPTION	Map Distribution					
				Master	IDD&E	PCSM	O&M	Impaired Waters	Spill Response
MS4 Outfall			Regulated system discharge point to a receiving waterbody, wetland, or ESA	X	X	X	X	X	X
MS4 Outfall (High Priority Area)			Regulated system discharge point to a receiving waterbody, wetland, or ESA; where the MS3 has been categorized as High Priority	X	X	X	X	X	X
Other MS4 Outfall			Regulated system discharge point to a receiving waterbody, wetland, or ESA; in a neighboring jurisdiction in which the regulated system is connected to	X				X	X
NPDES Outfall			Regulated system discharge point to a receiving waterbody, wetland, or ESA owned/operated by an entity with an MS4 Permit (e.g. PennDOT); in which the MS4 is connected to	X	X	X	X	X	X
NPDES Outfall (High Priority Area)			Regulated system discharge point to a receiving waterbody, wetland, or ESA owned/operated by an entity with an MS4 Permit (e.g. PennDOT); where the MS3 has been categorized High Priority; in which the MS4 is connected to	X	X	X	X	X	X
Private Outfall			Regulated system discharge point to a receiving waterbody, wetland, or ESA owned/operated on private property; in which the MS4 is connected to	X	X	X	X	X	X

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Don’t forget “other” outfalls that are applicable (cont’d)

ITEM	SYMBOL	CODE	DESCRIPTION	Map Distribution					
				Master	IDD&E	PCSM	O&M	Impaired Waters	Spill Response
Private Outfall (High Priority Area)			Regulated system discharge point to a receiving waterbody, wetland, or ESA owned/operated on private property; in which the MS4 is connected to and where the MS3 is categorized as High Priority	x	x	x	x	x	x
Other Outfall			Discharge point at a receiving waterbody, wetland, or ESA owned/operated by a private and/or non-permitted entity with no connection to the regulated MS4	x	x				
MS4 Discharge Point			A system transfer and/or discernable point of change of system type (e.g. end wall) that is not an outfall	x	x	x	x		x
NPDES Discharge Point			A system transfer and/or discernable point of change of system type (e.g. end wall) that is not an outfall; and owned/operated by an NPDES-permitted entity (e.g. PennDOT)	x	x	x	x		x
Private Discharge Point			A system transfer and/or discernable point of change of system type (e.g. end wall) that is not an outfall; and located on private property	x	x	x			x
Observation Point			An identified discharge point (other than an outfall) for screening/monitoring the nature of discharges and dry-weather flows; and up-stream of an outfall that is inaccessible	x	x				

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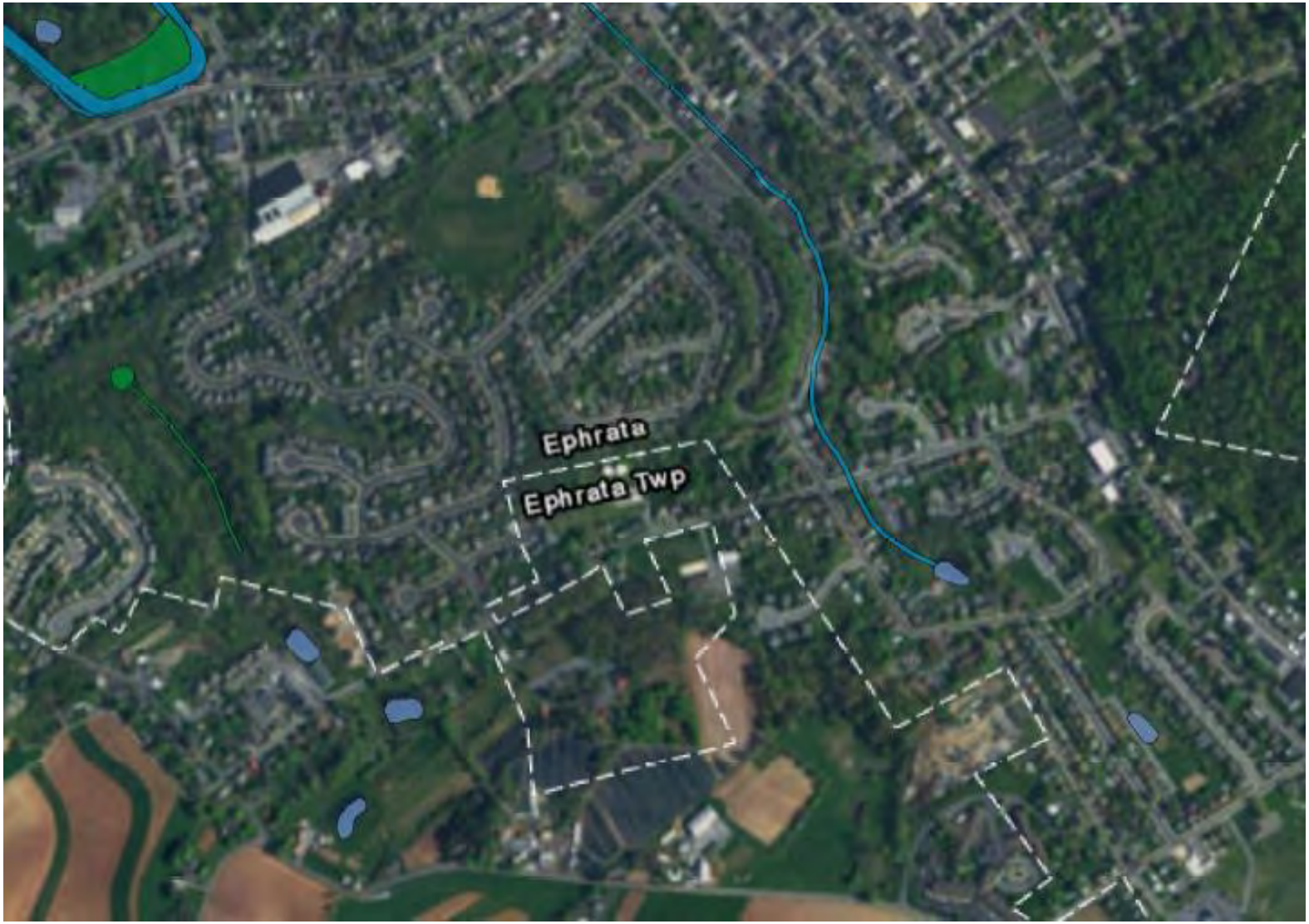
So now we feel good that we know what an outfall is, what do we do with this knowledge?

“It’s all about the streams”

Receiving waterbodies are those waterbodies with a defined reach code and/or common identifier, and found within the National Hydrography Dataset (NHD) and shown within the USGS database. PADEP WAVE Silverlight and/or eMapPA are further referenced for additional receiving waterbody information. The National Wetlands Inventory (NWI) is additionally referenced to locate jurisdictional wetlands that are treated as receiving waterbodies where discharge points (outfalls) are present. Per the Clean Water Rule, drainage from wetlands are not considered receiving waterways (unless the drainage channel is shown within the NHD and/or has a COMID).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EPHRATA BOROUGH MS4 RECEIVING WATERBODIES LIST - STREAMS and WATERBODIES (NHD) 8/14/16

General ID	Reach Code	COMID	Geographic Reference	Length (Mi.) (streams)	Area (ac) (w-bodies)	Protected Designated Uses	GNIS Name ("Common Name")	303(d) categorization	Waste Load Allocation	Impaired?	Impairment(s) (use-source-cause)
17092	2050306000177	57461871	Periodic segments of main stem including small segment SE of Cloverbrook Ave., small segment along Church Ave., and extended segment from near Wenger Ave. and Church Ave. intersection to municipal border just SE of confluence with Indian Run (~0.12 miles from confluence)	1.959		WWF, MF	Cocalico Creek	5	No	Yes	Aquatic Life - Crop Related Ag - Nutrients; Aquatic Life - Grazing Related Ag - Siltation; Aquatic Life - Urban Runoff/Storm Sewers - Unknown
								N/A	No	Yes	Recreational - Unknown - Pathogens
17092	2050306000176	57461933	Segment of reach from municipal border just SW of confluence with Indian Run (~0.06 miles from confluence) crossing Rt. 322 to the confluence with UNT ("Gross Run") adajcent to the W. Sunset Ave. and Cocalico St. intersection	0.855		WWF, MF	Cocalico Creek	5	No	Yes	Aquatic Life - Crop Related Ag - Nutrients; Aquatic Life - Grazing Related Ag - Siltation; Aquatic Life - Urban Runoff/Storm Sewers - Unknown
								N/A	No	Yes	Recreational - Unknown - Pathogens
71492	20503060004557	57462029	Headwaters (pond) of UNT ("Gross Run") just north of the Tom Ave. and E. Fulton St. intersection	0.016		WWF, MF	UNT Cocalico Creek ("Gross Run")	5	No	Yes	Aquatic Life - Crop Related Ag - Nutrients; Aquatic Life - Grazing Related Ag - Siltation; Aquatic Life - Urban Runoff/Storm Sewers - Unknown
								N/A	No	Yes	Recreational - Unknown - Pathogens
71492	20503060004557	57462027	Continuation of UNT ("Gross Run") from headwaters flowing north and following E. Fulton St. to the parking lot at the SE side of the Lake St. and E. Fulton St. intersection	0.424		WWF, MF	UNT Cocalico Creek ("Gross Run")	5	No	Yes	Aquatic Life - Crop Related Ag - Nutrients; Aquatic Life - Grazing Related Ag - Siltation; Aquatic Life - Urban Runoff/Storm Sewers - Unknown
								N/A	No	Yes	Recreational - Unknown - Pathogens

EPHRATA BOROUGH MS4 RECEIVING WATERBODIES LIST - WETLANDS (NWI)

Code	TYPE	Geographic Reference	Area (ac)	Code Decipher	NAME	Latitude	Longitude
PFO1A	Freshwater Forested/Shrub Wetland	Elongated wetlands adjacent and west to "Brickyard Circle Pond," Brickyard Circle, Sand Court, and Windsor Drive	0.45	P-Palustrine System; FO-Forested (6m or tall or taller woody vegetation); 1-Broad-leaved Deciduous); A-Temporary Flooded (water regime)	"Stinger Run wetlands"	40°10'16" N	76°11'12" W

Outfalls and receiving waterbodies

The end-of-system discharge point (to which an MS4 is connected) to receiving waterbody connection—an Outfall—is the **PRIMARY** interface between **YOUR** system and **WATERS OF THE U.S./SURFACE WATERS OF THE COMMONWEALTH.**

This interface is also the PRIMARY monitoring/screening location for an MS4 program in general.

The Outfall Interface is important

From an EPA inspection report…

Observation 1: At the time of the inspection, [redacted] did not have an accurate map that showed the location of all MS4 outfalls.

Build your map

Determined the primary base information….applicable receiving waterbodies and outfalls.

Build the rest of the map:

- Pipes, swales, etc. (anything that conveys stormwater and is connected to the regulated system)
- Entry points (inlets)
- Exit points (or outlets)
  - Also known as discharge points or system transfer points
  - Observation points
- **MS3 boundaries** (portion of system tied to a single outfall (or similar))

Why MS3 delineations are important

Observation 2: **At the time of the inspection, [redacted] was not conducting field screening of outfalls in priority areas twice a year.**

(iv) Guidance: EPA recommends that the plan to detect and address illicit discharges include the following four components:

- procedures for locating priority areas likely to have illicit discharges;

(1) Procedures for identifying priority areas. These are areas with a higher likelihood of illicit discharges, illicit connections or illegal dumping. Priority areas may include areas with older infrastructure, a concentration of high-risk activities, or past history of water pollution problems.

Establishing MS3s provides a very strong framework for the processes/procedures for determining Priority Areas.

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Priority Areas

Determination of Priority Areas is a critical process to help ensure the success of the SWMP overall. Priority Areas determine locations and general areas for focus of efforts to help the borough ensure compliance with the terms and conditions of the MS4 Permit. Priority Areas are inherently tied to MS3s. MS3s are not listed into a Priority Area classification until completion of an MS3 delineation process for a given area within a catchment. Upon completion of the MS3 delineation process, an individual MS3 is reviewed against a set of screening factors to prioritize the investigation process of all MS3s and ultimately classify an area. MS3s shall, at a minimum, consider the following screening factors (in order) for prioritization of the investigation process and/or revisiting classified Priority Areas during new permit cycles:

- Existing and known information (past complaints, reports (e.g. IDD&E reports, wet weather screening reports, etc.), Areas where it is known improvements or a need for improvements (e.g. removal of or remaining illicit connection, etc.) is required.
- Historic and/or active Combined Sewer Systems (CSS). Historic systems are areas where the combined system has been separated into sanitary sewer and storm sewer.
- Age of corresponding development and infrastructure within the MS3. Areas with development (specifically industrial) where the sanitary sewer is greater than 50 years old can be considered as having a high illicit connection potential.
- Sewer conversion areas – areas once serviced by septic systems, but have been converted to sanitary sewer connections

1) High Priority Area

- MS3s that collect stormwater runoff and are discharging to an area of concern to public health due to proximity of recreational areas, drinking water supplies, fish acquisition areas, or similar; and dry weather screening and/or

2) Problem Area (active investigation category)

- MS3s and/or MS4 outfalls with known or suspected contributions of illicit discharges and/or polluted wet weather discharges. Problem Areas are dictated by existing information. However, problems areas will be further

3) Low Priority Area

- Low Priority Areas include MS3s that are not discharging to an area of concern to public health; no dry weather flows are observed; wet weather screening has indicated the absence of elevated parameters; and/or illicit connections have been determined absent from the corresponding regulated

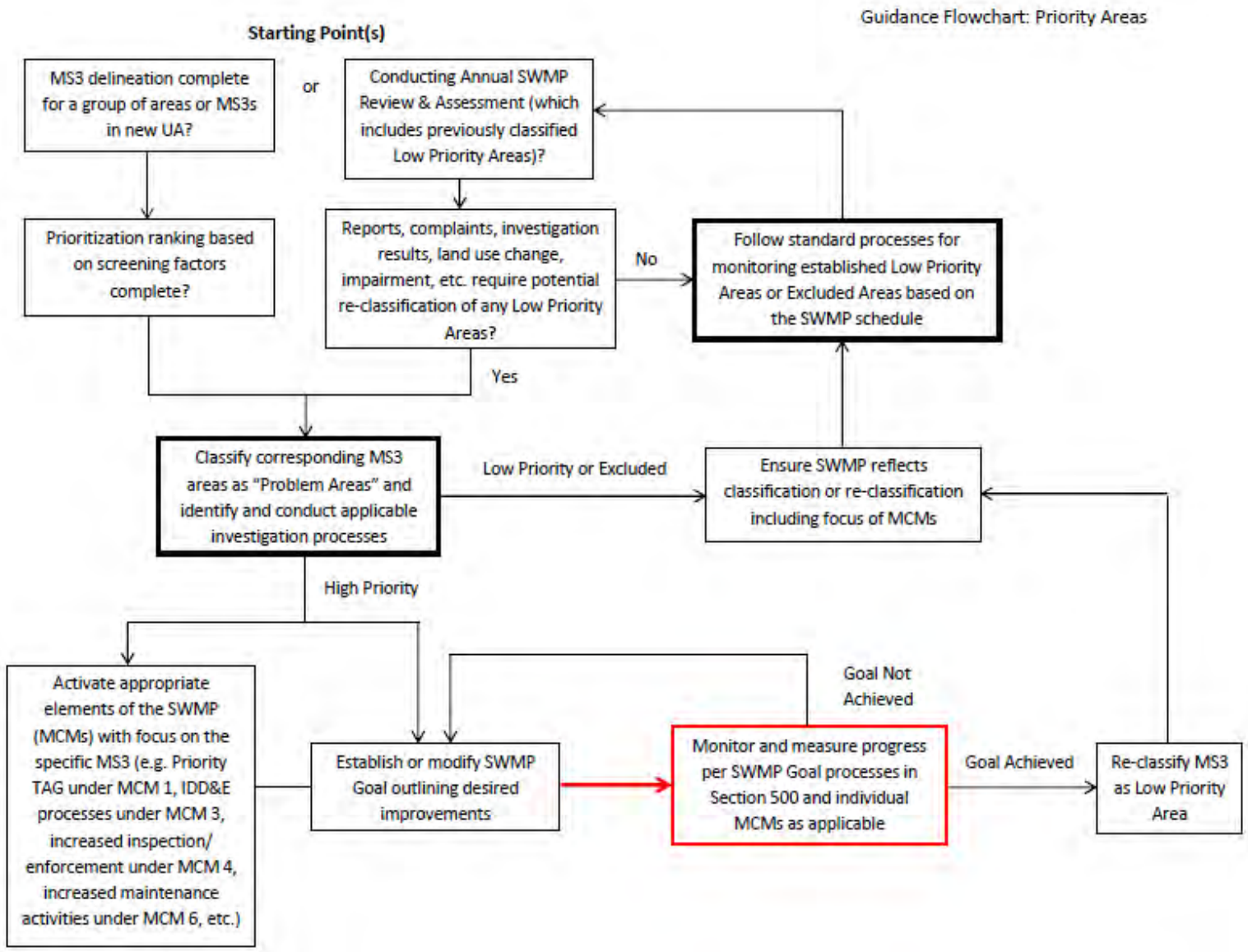
4) Excluded Area

- MS3s and/or areas within the UA with no potential for illicit or polluted discharges via outfall or system transfer.
- Example areas include roadway drainage in undeveloped areas, areas with no

Priority Area Screening and Classification Guidance Form

MS3 SCREENING PROCESS		Points
☐	Existing and known information (past complaints, reports (e.g. IDD&E reports, wet weather screening reports, etc.), Areas where it is known improvements or a need for improvements (e.g. removal of or remaining illicit connection, etc.) is required.	20
☐	Historic and/or active Combined Sewer Systems (CSS). Historic systems are areas where the combined system has been separated into sanitary sewer and storm sewer.	10
☐	Age of corresponding development and infrastructure within the MS3. Areas with development (specifically industrial) where the sanitary sewer is greater than 50 years old can be considered as having a high illicit connection potential.	8
☐	Sewer conversion areas – areas once serviced by septic systems, but have been converted to sanitary sewer connections.	6
☐	Poor receiving waterbody water quality.	6
☐	Dry weather flows observed.	6
☐	Presence of environmentally sensitive areas.	5
☐	MS3s with a high density of "generating sites." Generating sites are large industrial, institutional, manufacturing, and similar sites that generally can be called "campuses."	5
☐	MS3s with a high density of Industrial/Commercial zones and corresponding sites (car washes, gas stations, car dealers, manufacturing facility, etc.).	4
☐	High density of aging septic systems (greater than 30 years old) in residential areas.	3
	Total Points	

Priority Areas Flowchart



Outfall/MS3 Inventory

	OUTFALL/MS3 INVENTORY													
	MS3 ID	MS3 NAME	Sub-MS3		Sub-MS3	OUTFALL	OUTFALL DESCRIPTION							PRIORITY AREA CLASSIFICATION
			YES	NO			Location	Material	Shape	Dims	Other	Lat	Long	
Jeff Ave Wetlands (PUBHh)	029	Bethany Rd MS3		X		029	Open Drainage	Earthen (ditch)	Parabolic	3' wide x 2' deep	Vegetated banks			Low
	031	Jeff Ave MS3		X		031	Closed Pipe	HDPE	Circular	12"				Low
	030	Ridge Ave MS3	X		PennDOT	030	Closed Pipe	RCP	Circular	30"				High
Gross Run-HW(57462029)	027	Tom Ave MS3	X		PennDOT	027P	Open Drainage	Earthen (ditch)	Parabolic	3'wide x 4' deep	Eroded banks			Active

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SWMP **Development** – Step 1

The SWMP is your set of specifications to guide a program….a “choose your own path” book as well

Initially, gain an understanding and establish

- Receiving waterways (and health of the streams)
- Outfalls and MS3 boundaries
- Nature of the system (input points)

Establish procedures for reaching decisions, roles and responsibilities, assessment criteria, and so on

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Observation Points?

Checklist revisited

- System Map ✓
- Determining Priority Areas ✓
- Enforcement Procedures & Actions (incl. ordinance)
- Detecting illicit discharges
- Tracing a source of an illicit discharge
- Removing a source of an illicit discharge
- Evaluation and assessment
- Education

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Outfall Screening/Monitoring

Parameter Selection & Sampling

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SWMP **Implementation** – Step 2

Only consider the waterway and discharge point…**establish "pollutants of concern"**

Remember:

- The CWA is about protecting the beneficial uses of surface waters
- The CWA includes WQ Standards Requirements – that are about the stream
  - Designated Uses, WQ criteria, anti-degradation policy
- The NPDES is the mechanism in place to facilitate these requirements (MS4 Permit)

In turn, for SWMP development, a municipality needs to determine:

- "Is my MS4 discharging pollutants that are the same as the impairment of the waterway?"
  - Contributing to the impairment?
- "Is my MS4 discharging any pollutants that could impair the waterway?"

Sample discharges …understand health of the receiving waters

Wet weather parameter selection

The Pollutants of Concern are identified based on the following:

- Included on the current 303(d) list.
- Included within data found on PADEP WAVE/emappa.
- Encountered through the SWMP Development exercise.
- Encountered through two or more monitoring cycles within the established Monitoring Program.
- Listed as a concern within the issued MS4 Permit by the permitting authority (PADEP).
- A parameter of consideration of the water quality criteria associated with the Designated Uses of receiving waterbodies within the Urbanized Area (UA) (or the regulated system drains to the receiving waterbody).
- Determined as a concern by WCT based on appropriate rationale.

Wet weather parameter selection

The Pollutants of Concern for East Petersburg Borough and corresponding reasoning for listing are:

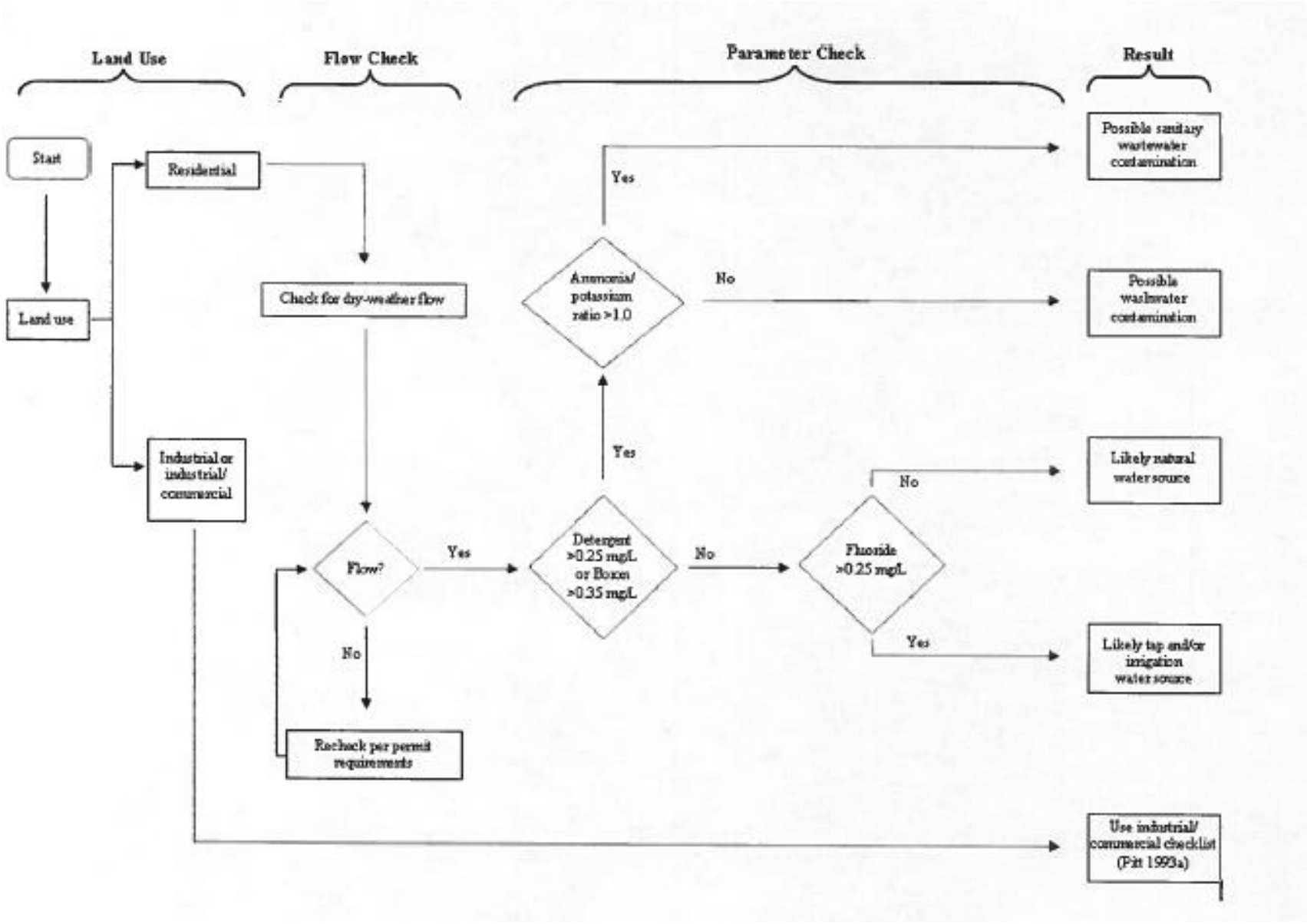
- Alkalinity
  - Parameter associated with TSF and MF Designated Uses
- Ammonia-Nitrogen
  - Parameter associated with TSF and MF Designated Uses
- Dissolved Oxygen (D.O.)
  - Parameter associated with TSF Designated Uses
- Iron (Fe)
  - Parameter associated with TSF and MF Designated Uses
- Nutrients (Nitrogen and Phosphorus)
  - Chesapeake Bay TMDL
  - 303(d) listed impairment for receiving waterways
  - Listed as a concern within the issued MS4 Permit
- Osmotic Pressure (OP)
  - Parameter associated with TSF and MF Designated Uses
- Pathogens (Bacteria) **(primary)**
  - 303(d) listed impairment for receiving waterways
- Petroleum, fuels, and oils
  - East Petersburg Borough determined concern – based on municipal operations and maintenance activities and field observations
- pH
  - Parameter associated with TSF and MF Designated Uses
- Sediment (siltation) **(primary)**
  - Chesapeake Bay TMDL
  - Listed as a concern within the issued MS4 Permit
  - 303(d) listed impairment for receiving waterways
- Temperature
  - Parameter associated with TSF Designated Uses
- Total Residual Chlorine
  - Parameter associated with TSF and MF Designated Uses

Dry weather parameter selection

Collect and analyze samples of the dry-weather flow.
If you identify a dry-weather flow at an outfall during field screening, take two grab samples of the flow. Analyze the samples for the characteristics and pollutants listed in the Table below.

Characteristic/Pollutant	Method
Color	Visual observation
Odor	Visual observation
Turbidity	Visual observation
Sheen/scum	Visual observation
pH	In-field analysis
Total chlorine	In-field analysis
Total copper	In-field analysis
Total phenol	In-field analysis
Detergents/surfactants	In-field analysis
Flow	In-field measurement
Bacteria	Laboratory analysis

Dry weather parameter selection



Dry weather parameter selection

Table 39: Indicator Parameters Used to Detect Illicit Discharges

Parameter	Discharge Types It Can Detect				Laboratory/Analytical Challenges
	Sewage	Washwater	Tap Water	Industrial or Commercial Liquid Wastes	
Ammonia	●	◉	○	◉	Can change into other nitrogen forms as the flow travels to the outfall
Boron	◉	◉	○	N/A	
Chlorine	○	○	○	◉	High chlorine demand in natural waters limits utility to flows with very high chlorine concentrations
Color	◉	◉	○	◉	
Conductivity	◉	◉	○	◉	Ineffective in saline waters
Detergents – Surfactants	●	●	○	◉	Reagent is a hazardous waste
E. coli Enterococci Total Coliform	◉	○	○	○	24-hour wait for results Need to modify standard monitoring protocols to measure high bacteria concentrations
Fluoride*	○	○	●	◉	Reagent is a hazardous waste Exception for communities that do not fluoridate their tap water
Hardness	◉	◉	◉	◉	
pH	○	◉	○	◉	
Potassium	◉	○	○	●	May need to use two separate analytical techniques, depending on the concentration
Turbidity	◉	◉	○	◉	

● Can almost always (>80% of samples) distinguish this discharge from clean flow types (e.g., tap water or natural water). For tap water, can distinguish from natural water.

Dry weather parameter selection

Water Quality Test	Field or Lab Test	Use of Water Quality Test
Conductivity	Field	Used as an indicator of dissolved solids. Used to distinguish between seawater and stormwater.
pH	Field	Extreme pH values (high or low) may indicate commercial or industrial flows. Not useful in determining the presence of sanitary wastewater (tends to have a neutral pH like uncontaminated base flows).
Temperature	Field	Sanitary wastewater and industrial cooling water can substantially influence outfall discharge temperatures.
Ammonia	Lab	High levels can be an indicator of the presence of sanitary wastewater
Surfactants	Lab	Indicate the presence of detergent (e.g. laundry, car washing)
Total Chlorine or Fluoride	Field	Used to indicate inflow from potable water sources. Not a good indicator of sanitary wastewater because chlorine will not exist in a "free" state in water for long (it will combine with organic compounds).
Potassium	Lab	High levels may indicate the presence of sanitary wastewater.
Bacteria	Lab	Sanitary wastewater or septic systems.

Dry weather parameter selection

Field Screening Parameters
Turbidity
pH
Conductivity
Temperature
Dissolved Oxygen
Ammonia-N
Dissolved Phosphorous-P
Nitrate-N
MBAS
Laboratory Analytical Parameters
Oil and Grease
Diazinon
Chlorpyrifos
Malathion
Total Hardness
Cadmium (dissolved)
Copper (dissolved)
Lead (dissolved)
Zinc (dissolved)
Coliform, total[4]
Coliform, fecal[4]
Enterococcus[4]

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Dry weather parameter selection

- Need two (2) sets of selected parameters
  - One as a “source indicator set” (for tracing unfound dry weather flows)
  - One as a “characterization indicator set” (for establishing is there are pollutants of concern in the dry weather flow)

- “Pitt Flowchart” as a source indicator set.

- Need to build the characterization indicator set based on local conditions, problems, observations, etc.
  - However, can start with the EPA baseline recommendations…

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Dry weather parameter selection

Collect and analyze samples of the dry-weather flow.
If you identify a dry-weather flow at an outfall during field screening, take two grab samples of the flow. Analyze the samples for the characteristics and pollutants listed in the Table below.

Characteristic/Pollutant	Method
Color	Visual observation
Odor	Visual observation
Turbidity	Visual observation
Sheen/scum	Visual observation
pH	In-field analysis
Total chlorine	In-field analysis
Total copper	In-field analysis
Total phenol	In-field analysis
Detergents/surfactants	In-field analysis
Flow	In-field measurement
Bacteria	Laboratory analysis

Sampling

Observation 4:

While on site, the EPA Inspection Team observed that [redacted] did not have equipment or sampling kits to collect and analyze dry weather samples if needed during outfall field screening. Staff from the Public Works Crew stated that a dry weather flow has never been observed except at Outfall 29, which was attributed to be from a basement sump pump. [redacted] has never taken dry weather samples and Public Works does not have water quality sampling kits.

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Sampling “Kits”

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Sampling “Kits”

SIDEBAR: Lab costs

300_WNO23	Nitrate/Nitrite	10	$15.00
365.1WTP	Phosphorus, Total	10	$19.00
NH3_IC	Ammonia-N	10	$13.00
S2130BTURB	Turbidity	10	$10.00
S2540DWTSS	Total Suspended Solids	10	$10.00
S4500CTKNW	Total Kjeldahl Nitrogen	10	$28.00
S9222WFCoD	Fecal Coliform	10	$18.00
S9223WColi	Total Coliform	10	$16.00
TOTALN	Nitrogen, Total	10	$5.00

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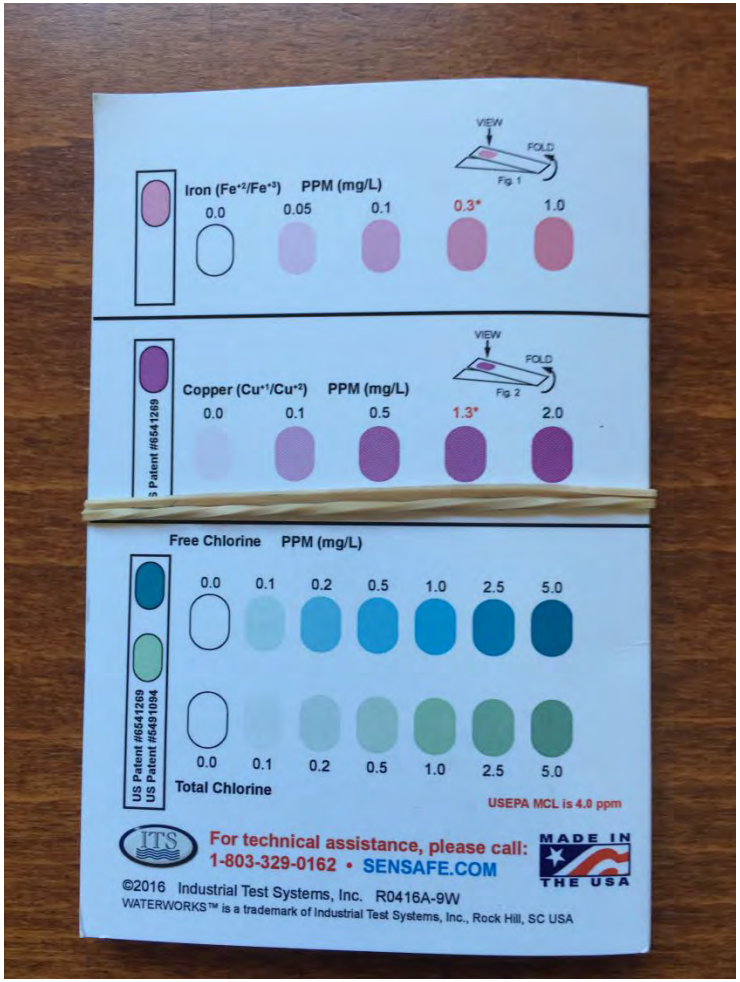
Field backpack contents

- “Nalgene” collection bottles
- DI water
- Gloves (powderless and work)
- First aid kit
- Test strips
- pH/temp meter
- Flashlight
- Multi-tool
- Markers, pens, pencils
- Notebook (with “instructions”)
- Baggies
- Lab wipes
- Detergent and coliform bottles
- Sample acquisition extension rod***



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Other kits and equipment for sampling

- pH/temp meter
- Colorimeter
- Flow gauge/meter
- D.O. meter (especially with CWF uses)

Colorimeter

Colorimeter considerations

- Clean cuvettes
- “Solutions” for each chemical parameter
- Calibration
- Time for setting up samples and analysis

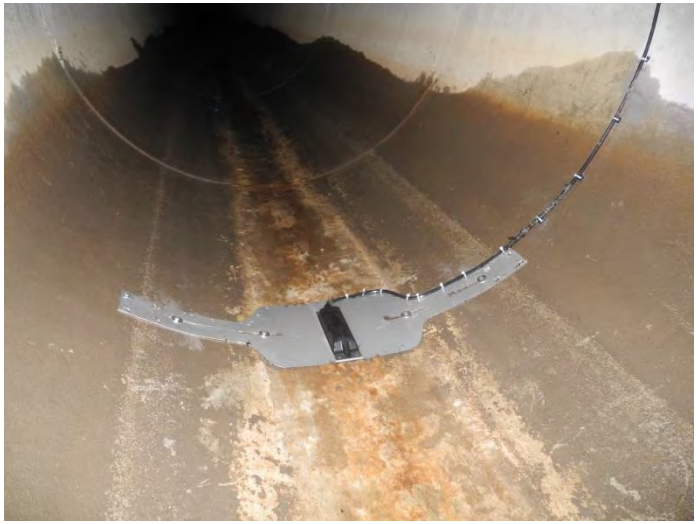
Colorimeter (nitrate)

Nitrate (NO_3)

1. Add 2 ml of sample using syringe into mixing container
2. Dilute to 15 ml mark with D.I. water
3. Pour cadmium packet into mixing container and cover with cap
4. Place in Vortex-Genie and shake for 3 minutes on setting 7 to 8
5. Let stand for two minutes **(Very important step!)**
6. Decant 10ml of the treated sample into a second sample cup, being careful not to transfer any cadmium particles to the sample cup
7. Break ampoule in sample cup to suck up sample, invert several times to mix, and wait 10 minutes for color development
8. Place zeroing ampoule in V-2000, cover with light shield and press the **zero** key
9. Press the **prgm** key, enter **121**, insert ampoule to be tested, cover with light shield and press **meas** key (note; if wait time has elapsed, press the **timer** key to bypass countdown)
10. Read the V-2000 sample value in milligrams/Liter for NO_3 and record in appropriate cell

pH/temp meter

Flow meters



Sampling “locations”

Sampling “locations” (stream sample)

Field Sample Collection - Grab samples (see below for Oil and Grease grab sample procedure) are to be collected by standing downstream and submerging the sample container immediately below the water surface in the upstream direction, disturbing as little of the bottom material as possible. If practical, collect the sample at about 60% of the stream depth (from the surface) in an area of maximum turbulence (except when sampling for volatile organics). If the water level is very low, collect the water sample using a clean syringe and fill sample container. Note on the field sheet if a syringe was used for sample collection. Avoid sampling the slowly flowing water near the edge of stream, unless intended. For Oil and Grease grab sample collection, fill bottle with water at the water-air interface, and avoid collecting sediments.

SIDEBAR: “Observation points”

Different sampling points depending on nature of system and access to outfalls or source of potential polluted discharge.

“Light” dry weather flows

How to sample – with lab analysis involved.

- Ensure collection bottles are clean.
- Put on gloves.
- Rinse collection bottle 3 times with water to be collected and analyzed.
- Collect sample.
- Enter field notes.
  - Including visual observations (if applicable)
- Enter information on analysis bottle.
- Transfer sample to analysis bottle (with preservative if applicable).
  - Shake bottle up
- Put analysis bottle in cooler (on ice).
- Fill out COC form.

The above applies even if you are taking samples back to your “own” lab.

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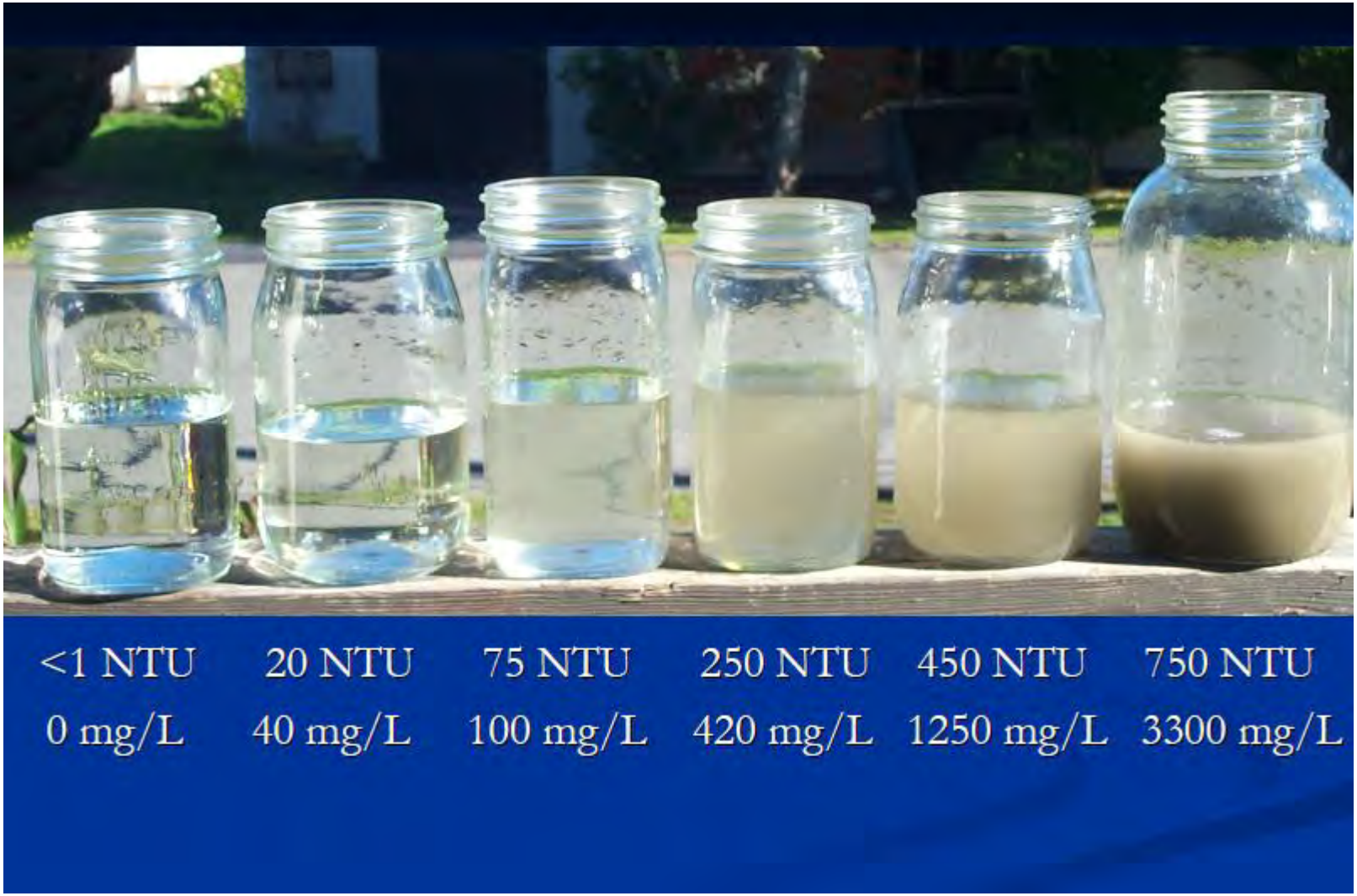
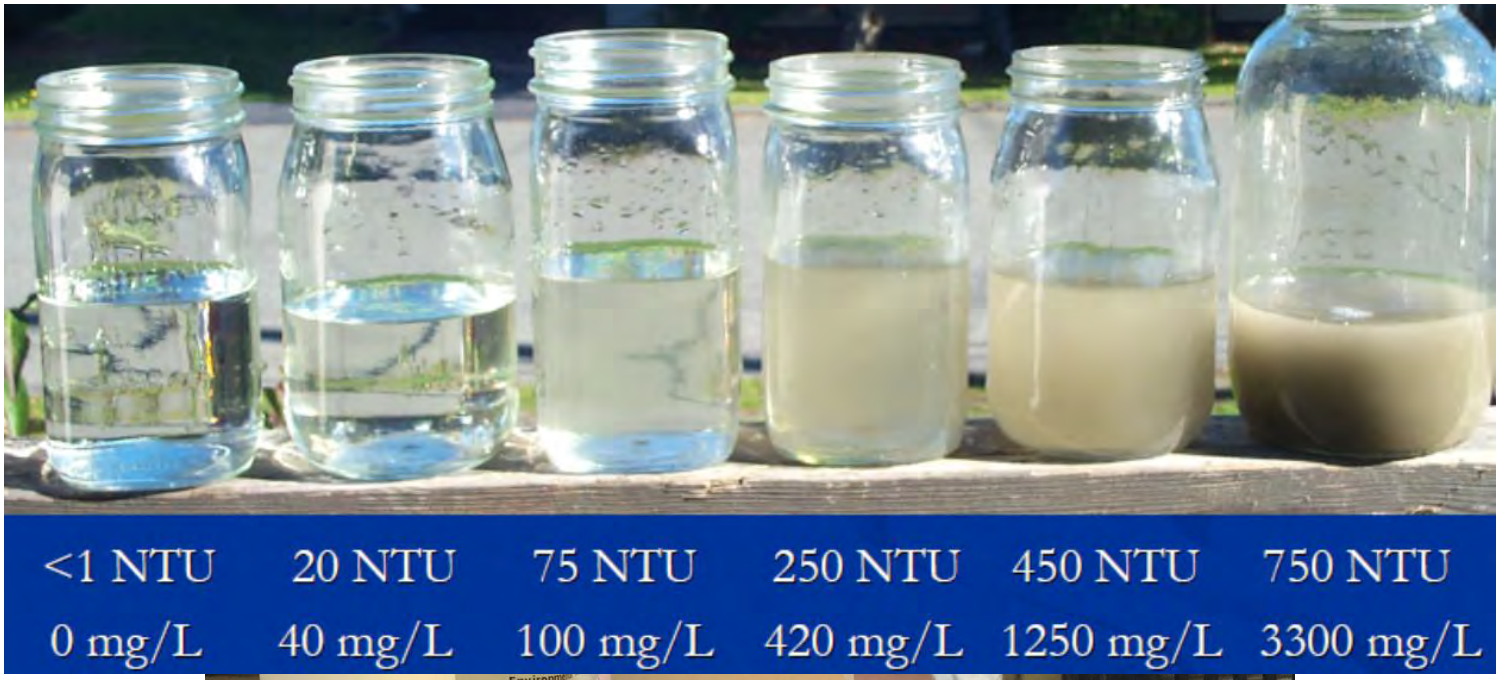
TSS vs. turbidity



TSS vs. turbidity



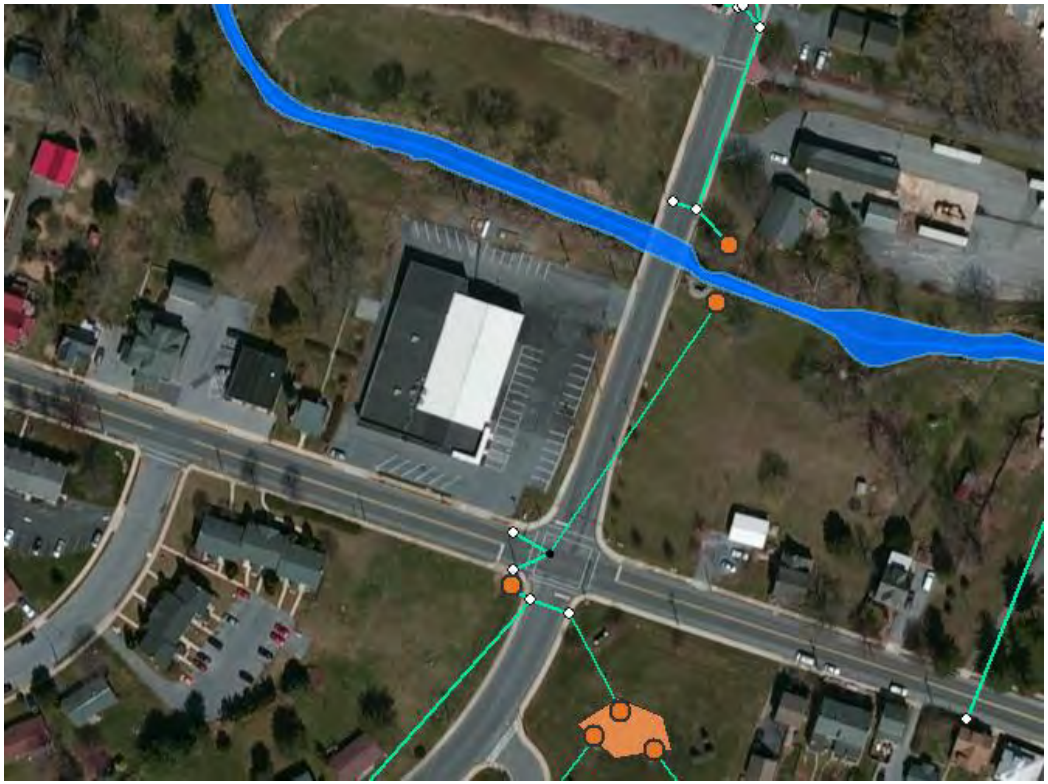
<1 NTU	20 NTU	75 NTU	250 NTU	450 NTU	750 NTU
0 mg/L	40 mg/L	100 mg/L	420 mg/L	1250 mg/L	3300 mg/L

Visual or lab analysis

CATEGORY	CHEMICAL/MATERIAL	OBSERVATIONS	ANALYSIS INDICATORS	NOTES
Asphalt	Hot Asphalt	Visually Observable: Rainbow surface and/or brown suspension	No testing required (visually observable)	
	Liquid Asphalt			
	Cold Mix			
	Asphalt Concrete			
Cleaning Products	Acids	Not Visually Observable	High pH and acidity	pH meter
	Bleaches		Chlorine	Chlorine test kit
	Solvents		VOC & SVOC	EPA methods req.
	Detergents	Foam	No testing required (visually observable)	
	Ammonia	Strong smell	Ammonia	Ammonia meter
Concrete and Masonry Products	Portland Cement (PCC)	Milky liquid	No testing required (visually observable)	
	Mortar			
	Concrete Rinse Water			
	Masonry Products	Not Visually Observable	Low pH and alkalinity	pH meter
	Concrete/Masonry Sealants	Not Visually Observable	Methyl Methacrylate, Cobalt, Zinc	EPA methods req.
Landscaping Products	Soil Amendments	Not Visually Observable	Nitrates, Phosphates, Sulfates, Other Metals	EPA methods req.
	Fertilizers			
	Herbicides & Pesticides		Herbicide and pesticide chemicals	Per lab
	Lime		alkalinity	pH meter
	Soil & Sediment	Cloudiness, muddy, turbidity	No testing required (visually observable)	
Other	Petroleum, Fuels, & Oils	Rainbow Surface, Sheen, and Odor	No testing required (visually observable)	
	Chlorinated Water	Not Visually Observable	Total Chlorine	Chlorine test kit
	Adhesives		Phenols, SVOC	EPA methods req.
	Salts (Magnesium Chloride, Calcium Chloride, and Natural Brines)		Chloride, Cations, TDS	TDS Meter, EPA methods req.
	Antifreeze and similar	Colored liquid	No testing required (visually observable)	
	Batteries	Not Visually Observable	Lead, sulfuric acid, pH	pH meter & other

Outfall “016” – Base information

General ID	REACH CODE	COMID	Geographic Reference	Length (Mi) (streams)	Area (ac) (w-bodies)	Protected Designated Uses	Existing Uses	GNIS_NAME	303(d) categorization	Waste Load Allocation? (Y/N)	Impaired? (Y/N)	Impairments (use-source-cause)
13648	2050306001450	57462425	Confluence with UNT ("Carter Run") to eastern borough boundary past Oak St.	0.41		WWF; MF	CWF	Santo Domingo Creek	4a	Y - Sediment	Y	TMDL - Aquatic Life - Urban Runoff/Storm Sewers - Suspended Solids
									N/A	N	Y	Recreational - Unknown - Pathogens



Outfall “016” – MS3

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Outfall “016” – MS3 notes

General observations and conditions encountered

- SIGNIFICANT LANDSCAPE DEBRIS ON INLETS
- MINIMAL SEDIMENT IN GUTTERS OBSERVED
- LANDSCAPE DEBRIS BUILD-UP @ OUTFALL
- PRIMARILY LOW DENSITY / MED. DENSITY RESIDENTIAL (INCLUDES PORTION OF LITTER ACRES)
- NO DRY WEATHER FLOW OBSERVED (IN) SYSTEM
- SEVERAL "RAIN IN DRAIN" EMBLEMS MISSING
- "016" IS AN MS4 OUTFALL

Outfall “016” – dry weather flow present

- No dry weather flow observed in any other observable areas of the MS3 and system.

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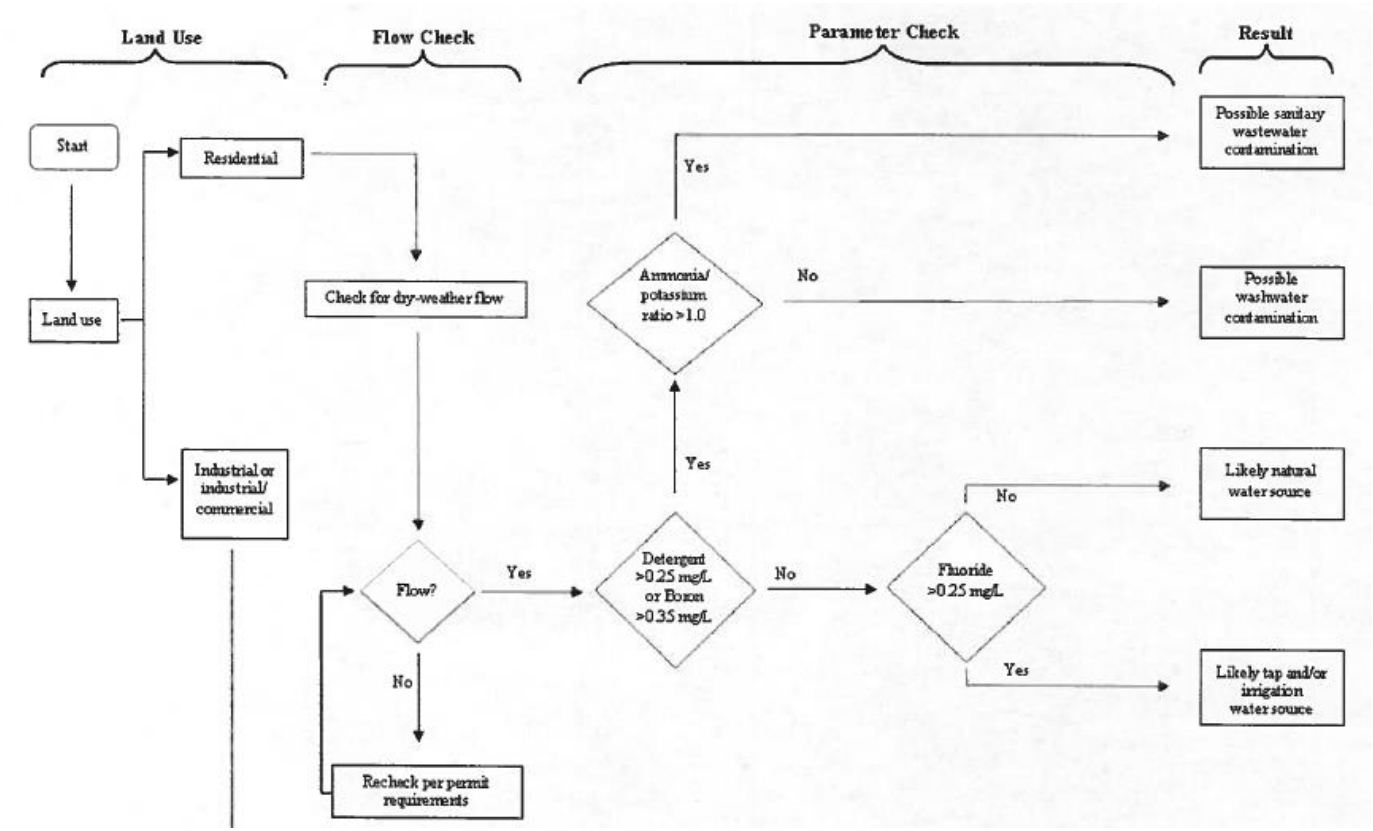
Outfall “016” – dry weather flow source identification

Pitt Flowchart

- Ammonia, Potassium, detergent, Boron, and Chlorine



Outfall “016” – dry weather flow source identification

Land Use? Residential

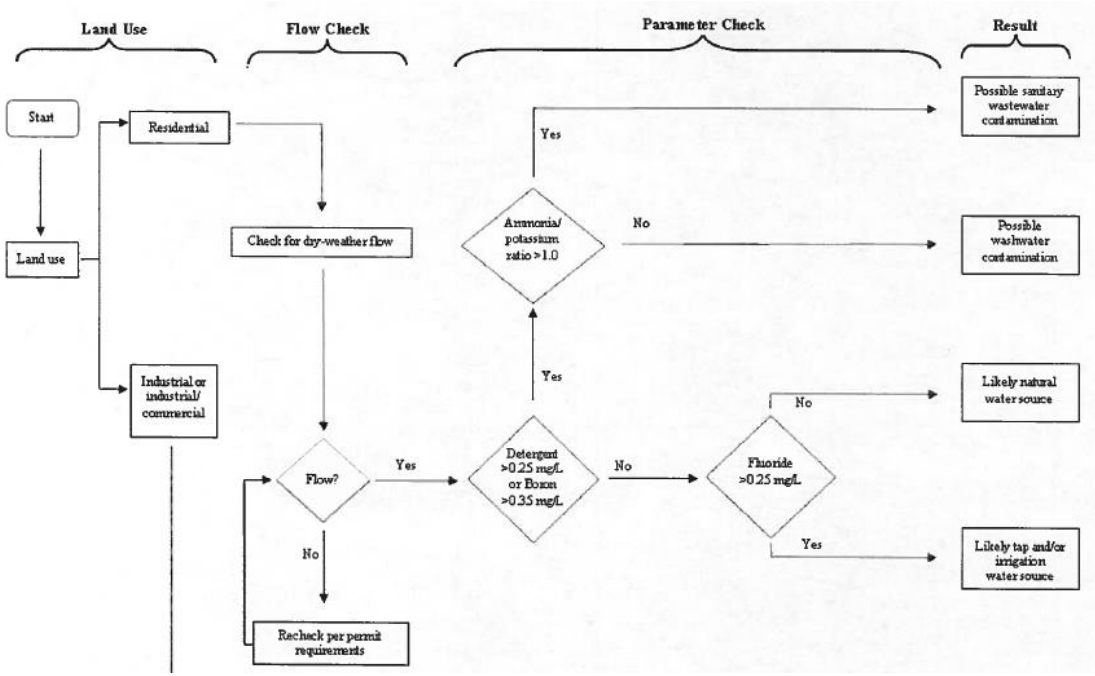
Flow? Yes

Detergent or Boron? No

Fluoride (chlorine)? No

Likely natural water source

However…



Outfall “016” – dry weather flow source identification

Also tested for fecal Coliform and total coliform of the dry weather flow only.

- Results came back with elevated fecal coliform readings

Somewhat of a conundrum…first “inkling” for fecal readings would be sanitary sewer infiltration (or similar). But Pitt Flowchart indicated “likely natural water source.”

Outfall “016” – wet weather sampling

WET CHEMISTRY				
Ammonia-N	0.991	mg/L	0.100	D6919-09
Nitrate/Nitrite-N	0.70	mg/L	0.20	EPA 300.0
Phosphorus, Total	ND	mg/L	0.10	EPA 365.1
Total Kjeldahl Nitrogen	ND	mg/L	1.0	S4500NH3G-11
Total Nitrogen	ND	mg/L	1.70	Calculation
Turbidity	7.72	NTU	0.10	S2130B-01

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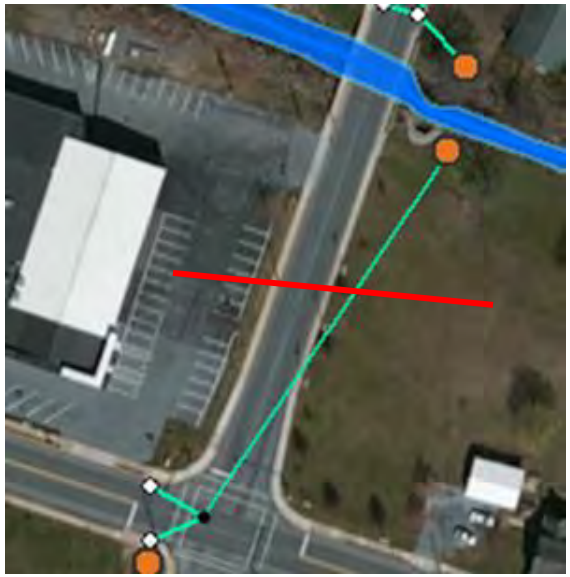
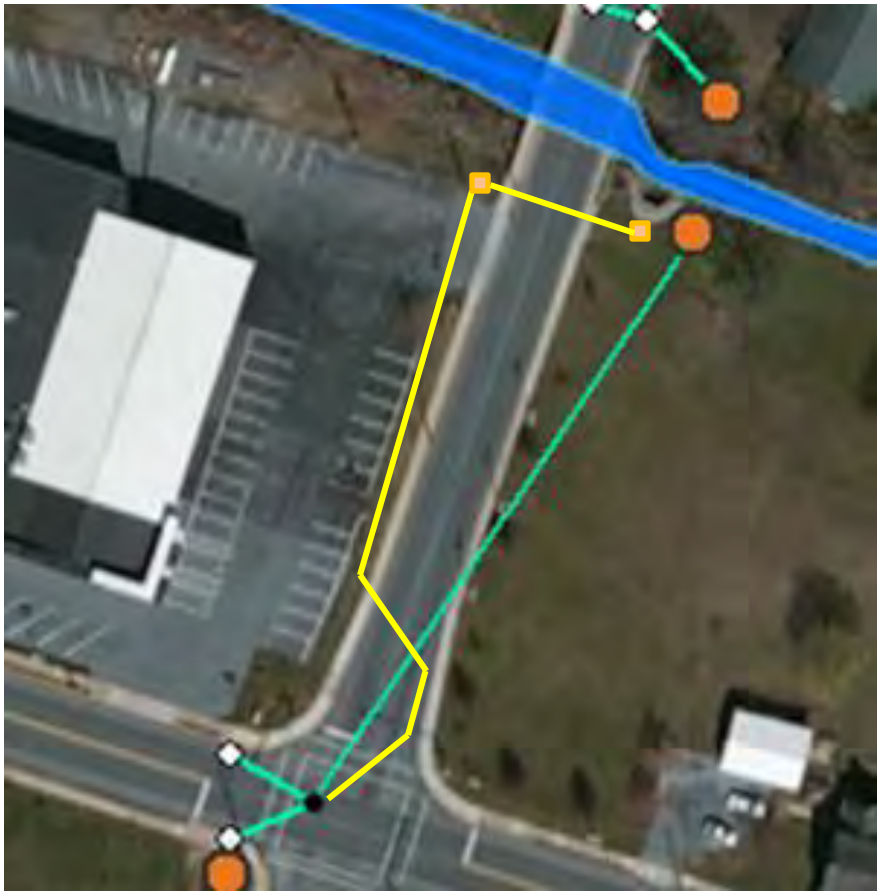
Outfall “016” – dry weather flow source identification

Found a sanitary sewer line “crossing over” the MS4



ITEM	SYMBOL	CODE	DESCRIPTION	Map Distribution					
				Master	IDD&E	PCSM	O&M	Impaired Waters	Spill Response
Alley/Access Drive				x	x	x	x	x	x
Sanitary Sewer Line					x		x		
Water Line					x		x		

Outfall “016” – dry weather flow source identification



Climbed in and “explored”

Found two manholes with covers buried under dirt/turf

Outfall “016” – dry weather flow source identification

Outfall “016” - notes to consider

- Pitt Flowchart is a good tool to use if the source cannot be tracked down visually to help dial-in a potential source (Source Indicator Set).
- Cannot rely simply on sampling…have to get into the field.
- Some time (along with a banged up knee and ruined pair of jeans) would have been saved if the map was accurate to begin with.
- Field observations, land uses, etc. play a role in a determining parameters to test for…start with a stable of parameters to choose from (Characterization Indicator Set).
- Start with visual investigation if dry weather flow encountered…use test strips to determine what parameters for lab analysis.
- EXAMPLE SPECIFIC NOTE: Fecal loading is coming from somewhere up-stream…leaning towards sewage infiltration with elevated ammonia readings as well

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Recommendation – In my opinion…

Do not conduct tasks for simply conducting the task with the perception it is for permit compliance…waste of time, money, resources, etc.

Outfall Screening/Monitoring

Primary IDD&E Processes

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IDD&E Processes

- Processes and procedures associated with pollutants and **PRIOR TO** system entry.
- Processes and procedures associated with pollutants and **IN** the system.
- Processes and procedures associated with discharge (or **EXIT**) from the system.

Screening/monitoring applies to all three processes.

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IDD&E Processes – PRIOR TO Entry

Simply need to be “on the lookout” as the baseline process.

IDD&E Processes – PRIOR TO Entry

However, simply “on the lookout” is much more comprehensive than it may sound.

MS3 field investigations also plays a role with **PRIOR TO** system entry.

IDD&E Processes – PRIOR TO Entry

What to look for…

IDD&E Processes – PRIOR TO Entry

What to look for…

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IDD&E Processes – PRIOR TO Entry

PRIOR TO processes also include considerations for sites, influences, etc. that you are aware of and know such areas could negatively impact the MS4.

IDD&E Processes – PRIOR TO Entry

Construction site(s) and/or earth disturbance activities that can impact or negatively influence the MS4…protect entry points

SIDEBAR: Enforcement

Observation 5:

At the time of the inspection, [redacted] had not taken an enforcement action or issued a penalty for violations of erosion and sediment control (ESC) related provisions in their Stormwater Management Ordinance (Ordinance) since the start of their permit coverage in 2004. Section 801.3 of the ordinance authorizes and directs [redacted] to enforce all provisions of the Ordinance. Section 701.3 of the Ordinance details the developer's ESC maintenance responsibilities during development of a project, including "periodic maintenance of temporary control facilities such as replacement of straw bale dikes, straw filters, silt fence, or similar measures" (see

IDD&E Processes – IN System

Wet weather observations/investigations play a more dominant role with **IN** system processes.

System maintenance under MCM 6 also plays a role for **IN** system processes.

PRIOR TO and IN system processes are inherently related.

IDD&E Processes – IN System

What to look for…

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IDD&E Processes – IN System

IDD&E Processes – EXIT from the System

This is where outfall screening comes into play.

- It is a “third level” process through observations at the end of the MS3 and at the interface with the receiving waterbody.
  - If the first two processes (PRIOR TO and IN the system) did not result in identifying potential and/or observed illicit, polluted, etc. discharges…these processes are the “back-stop” actions.

Dry weather and wet weather screening/monitoring play a role.

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IDD&E Processes – EXIT from the System

Process guidelines for dry weather screening…

- Selection of outfalls/discharge points for dry-weather screening.
  - Follows the IDD&E Plan update with the date(s) selected denoted in the SWMP schedule.
    - The date may be selected during the IDD&E Plan update process. However, the SWMP defaults to a later selection date to allow any set-up activities that may be required prior to date selection (e.g. Priority Area investigation and re-classification based on results of the annual review).
  - High Priority Area/Problem Area outfalls/discharge points are dry-weather screened twice annually.
  - Low Priority Area outfalls/discharge points are dry-weather screened once a year.
  - The list (dry weather screening inventory) of outfalls/discharge points selected and/or confirmed for screening (and corresponding priority area classification) for the upcoming permit year is updated and inserted into the IDD&E Plan.
  - The SWMP schedule is updated to reflect timeframes for dry-weather screening.

IDD&E Processes – EXIT from the System

Dry weather screening note…

Observation 3: At the time of the inspection, the former Superintendent of Public Works stated that not all outfall field screening was conducted after 72 hours following a rain event. According to the August 20, 2012, outfall inspection forms for outfalls 25 through 27 and 29 through 37 (see Exhibit 3 in Appendix 4), more than 0.1 inches of precipitation was received within 72 hours prior to the inspection.

Checklist revisited

- System Map ✓
- Determining Priority Areas ✓
- Enforcement Procedures & Actions (incl. ordinance)
- Detecting illicit discharges
- Tracing a source of an illicit discharge
- Removing a source of an illicit discharge
- Evaluation and assessment
- Education

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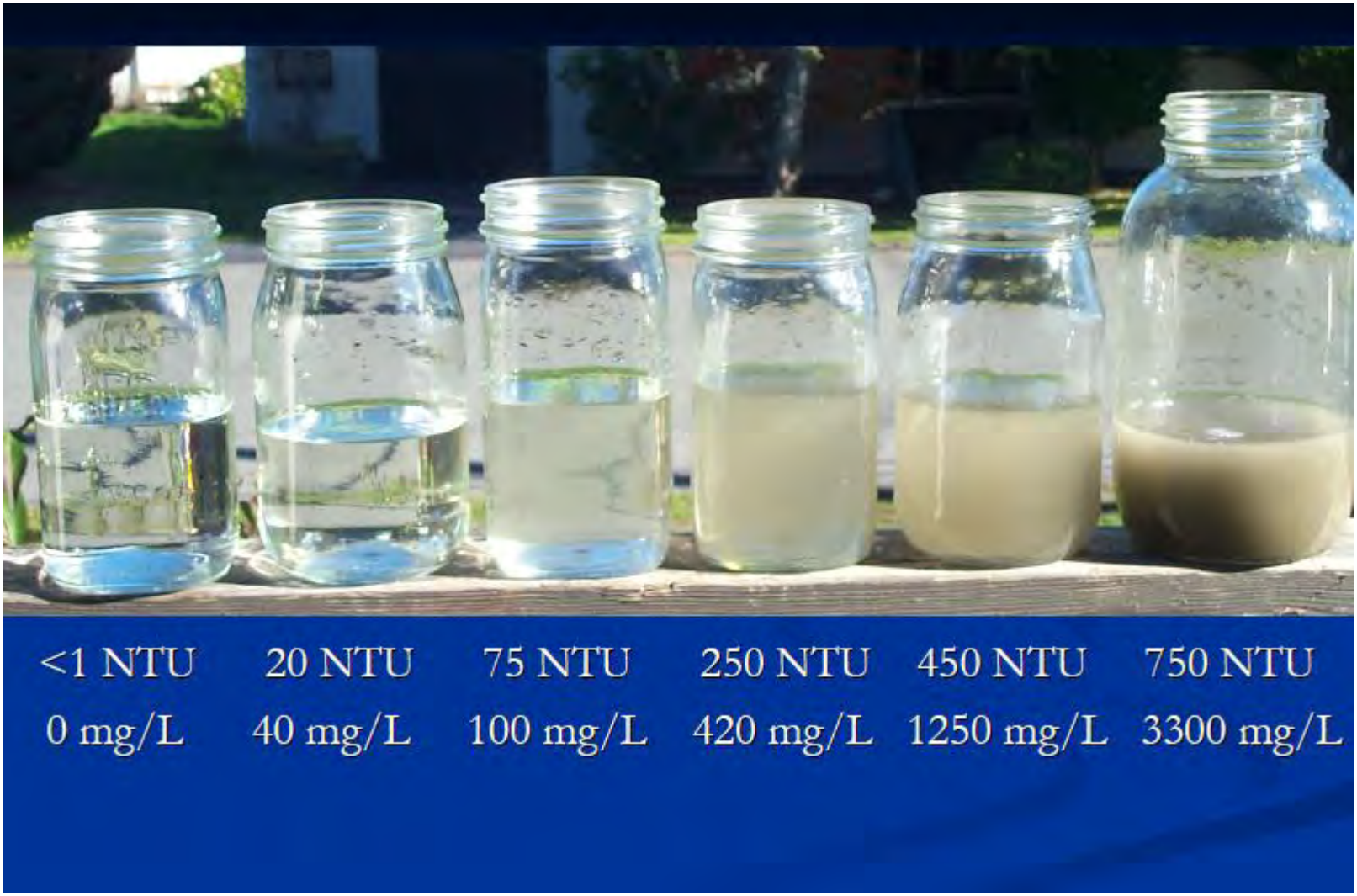
IDD&E Processes – Detection

- Know your Priority Areas…changes in area (e.g. active construction site) should “kick up” a Low Priority MS3 to an Active or High Priority Area
- MS3 field investigations (field observations)
- “On the lookout” during dry weather and wet weather events
- MCM 6 maintenance activities
- Dry weather and wet weather outfall screening
- Grab samples if you can…and not necessarily for lab analysis

TSS vs. turbidity



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IDD&E Processes – Tracing

General considerations…

- Trace back the “flow” visually (applies both in the system that cannot be seen (e.g. inlet to inlet) and the system that can be seen (e.g. swales, gutter lines, etc.) to a source.

- Below ground systems may require:
  - Dye or smoke testing
  - Camera investigation
  - **System access reviews (e.g. manhole to manhole)**
  - “Pitt Flowchart”

IDD&E Processes – Outfalls (Detection and Tracing)

Dry weather screening for Outfalls, discharge points, and “observation points”

- SWMP and IDD&E schedule outline timeframes for dry weather screening.
- When in the timeframe, monitor weather forecasts and data to allow dry weather screening to occur in the appropriate window of time.
- If dry weather flow encountered, first attempt to trace source visually up the system (e.g. walk the inlets, manhole-to-manhole).
- Whether or not the source can be traced visually, note parameters that can be visually screened and use test strips to provide an indication of the presence of certain pollutants of concern.
- If the source cannot be traced visually, implement the “Pitt Flowchart” to assist with source identification.
- Grab samples from a selection of the Characterization Indicator Set either during the current exercise, or as a follow-up based on the results of the “Pitt Flowchart” analysis.
    - Preference would be to grab samples at the same time.
- “Wait” for results to dictate next steps.

IDD&E Processes – Tracing (sidebar)

Very common to encounter pipe ends in inlet basins that are not documented or it is unknown what they are connected to…especially in older communities.

Sometimes the pipe can be traced back to a downspout (or similar)…but there are times they cannot.

To determine potential source…place a catch (e.g. bucket) under pipe and monitor (frequently at first). Will help to determine if pipe end is still connected to an illicit source.

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IDD&E Processes – Removing

Removing a source is inherently tied to enforcement.

Removing a source is highly dependent on

- The location of the source
- Nature of the source

Enforcement does not necessarily mean fines, penalties, etc.

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IDD&E Processes – Removing (Enforcement)

- Enforcement and follow-up protocols
  - First-time offenders offered guidance and/or education.
  - Second-time offenders provided written warning.
  - Enforcement is provided for repeat offenders and/or repetitive violations.

Checklist revisited

- System Map ✓
- Determining Priority Areas ✓
- Enforcement Procedures & Actions (incl. ordinance) ✓
- Detecting illicit discharges ✓
- Tracing a source of an illicit discharge ✓
- Removing a source of an illicit discharge ✓
- Evaluation and assessment
- Education ✓

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Outfall Screening/Monitoring

Wet Weather/Dry Weather

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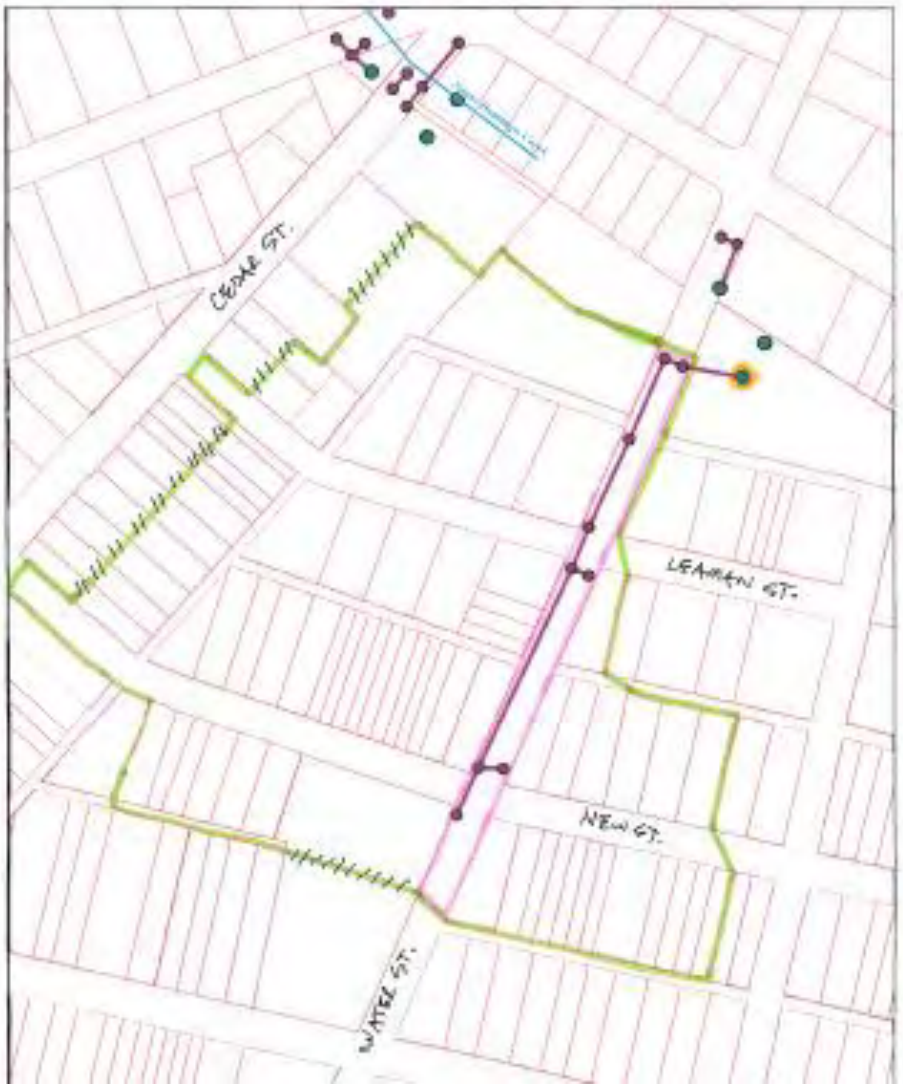
Outfall “029” – MS3



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Outfall "029" – MS3 Delineation Notes

General observations and conditions encountered

- EMBLEMS MISSING ON WATER ST. INLETS
- LANDSCAPE DEBRIS BUILD-UP IN WATER ST. INLETS
- UNKNOWN RESIDUE IN GUTTER LINE ON WATER
- MISC LANDSCAPE DEBRIS IN GUTTER ON WATER, OTHER STREETS
- MINOR STONE WASH OUT AT DRIVEWAY LANE ONTO WATER
- MOSTLY STABLE LANDSCAPES... DOES NOT APPEAR OF MUCH OF FERTS/HERBICIDES
- MINOR DEBRIS AND LITTER
- WATER ST. IS PENNDOT R.O.W, GUTTERS ON MOST ROADS

Specific deficiencies encountered

- DEBRIS BUILD-UP UNDER WATER ST. BRIDGE
- STAGNANT WATER / FILM AT INLET BOTTOM AT NW CORNER OF LEAMAN : WATER
- PAVEMENT IN ALLEY SOUTH AND PARALLEL TO NEW ST. HAS SIGNIFICANT BREAK-UP, POTHOLE-TYPE AREAS, AND SIMILAR

Outfall “029” – Wet weather sampling results

WET CHEMISTRY					
Ammonia-N	0.952		mg/L	0.100	D6919-09
Nitrate/Nitrite-N	1.1		mg/L	0.20	EPA 300.0
Phosphorus, Total	0.17		mg/L	0.10	EPA 365.1
Total Kjeldahl Nitrogen	ND		mg/L	1.0	S4500NH3G-11
Total Nitrogen	ND		mg/L	2.10	Calculation
Turbidity	19.1		NTU	0.10	S2130B-01
MICROBIOLOGY					
Fecal Coliform	220000	1	col/100mL	1	S9222D-97
Total Coliform	>2419.6 COL/100 ML		col/100mL	1	S9223B-04

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SIDEBAR: What do fecal coliform numbers tell us?

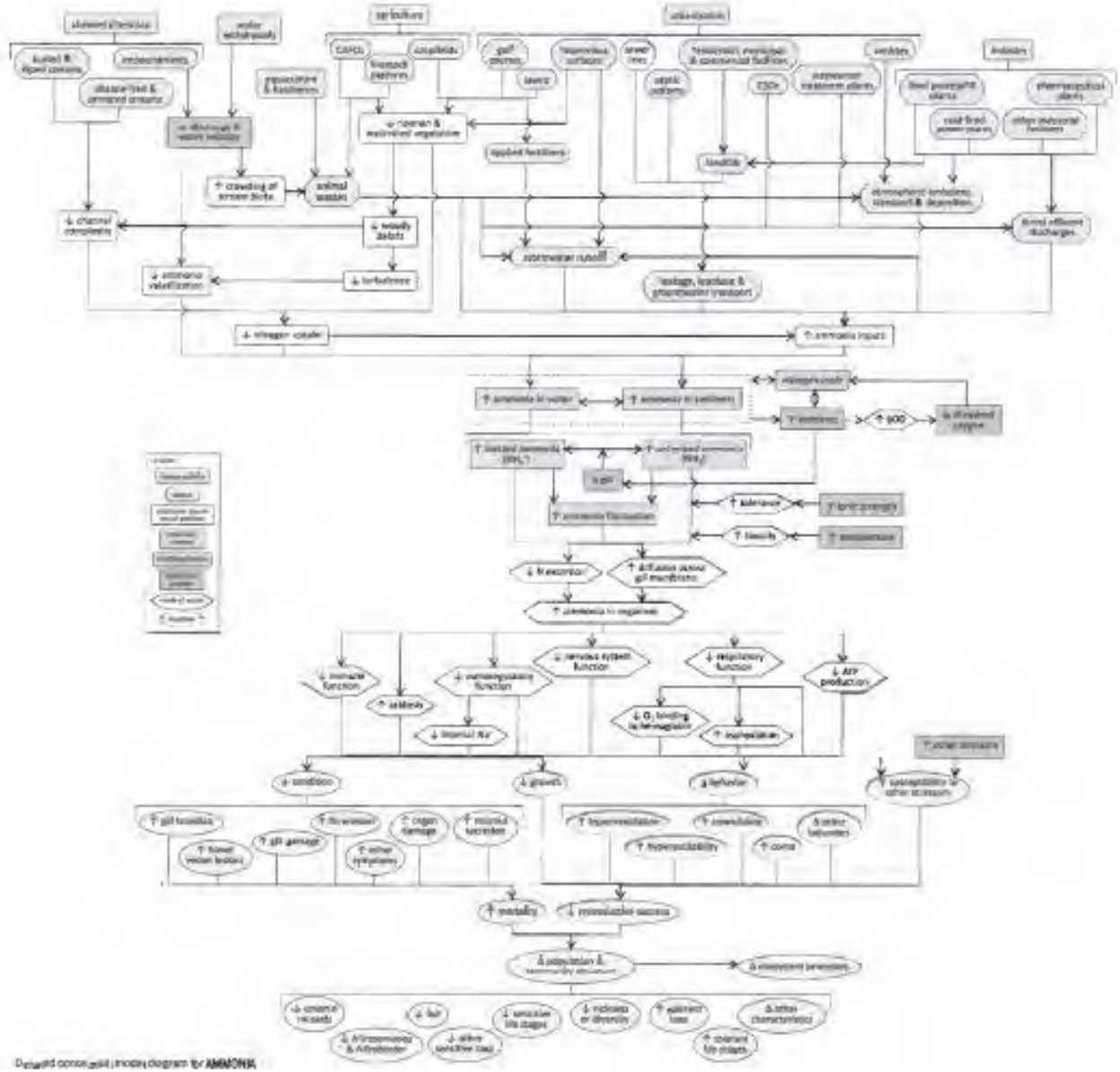
I use a sort of conversion chart developed by a gentleman named Art Ludwig to convey possibly what the fecal readings may indicate (the conversion may be received as unprofessional, but it was developed this way and does convey the readings in a different way), and it does help dial-in possible sources…

- First flush puddle of urban runoff: 3,360 col/100mL – equates to ~1/3 of an average "turd" floating in an average size swimming pool (in other words…just 1/3 of an average single "turd" in a swimming pool).
- Typical greywater readings: 4,000 col/100mL – equates to roughly 2/5 of an average "turd" in a swimming pool
- High reading in a lagoon associated with a beach area with presence of septic systems: 10,000 col/100mL – equates to 1 "turd" in a swimming pool.
- First flush of a river after seven dry months: 25,600 col/100mL – equates to roughly 2 ½ "turds" in a swimming pool
- Typical level in bathwater: 400,000 col/100mL – equates to roughly 40 "turds" in a swimming pool
- Possible (and actual) reading of raw sewage: 5,000,000 col/100mL – equates to 500 "turds" in a swimming pool

Outfall “029” – Key observations

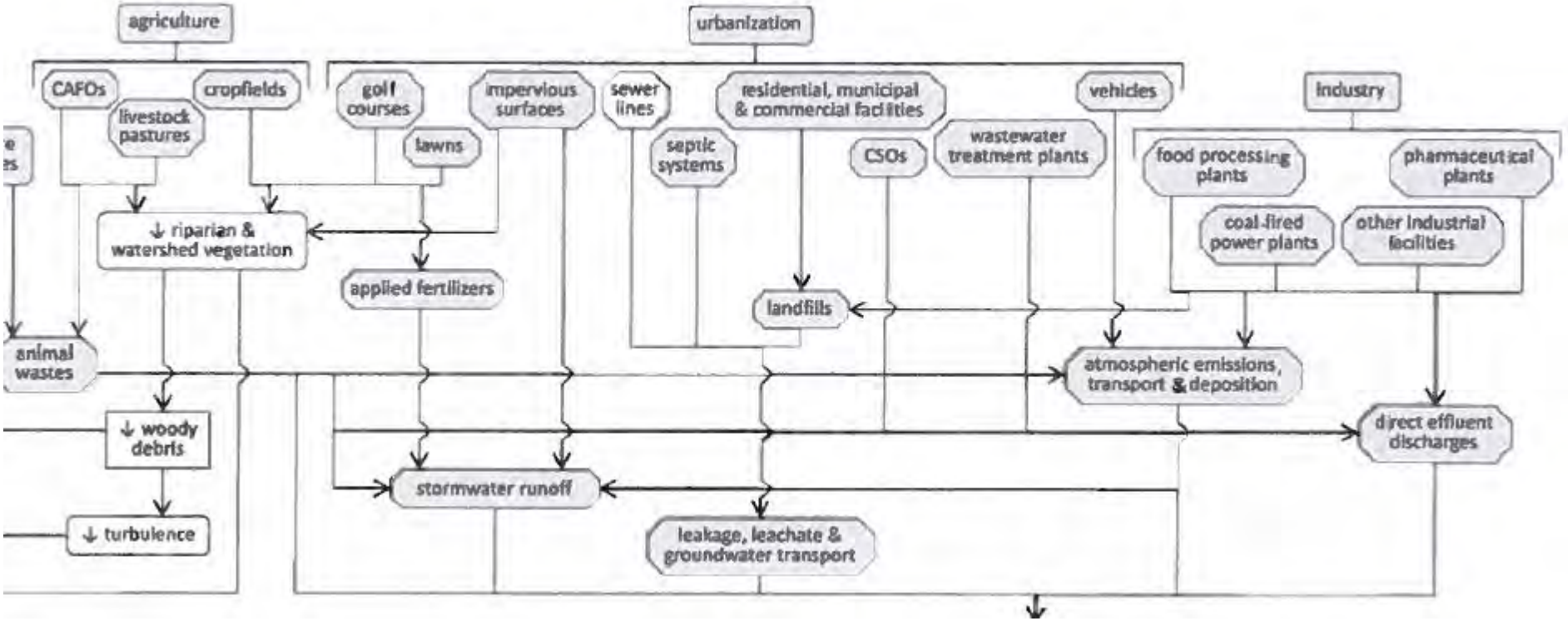
- Periodic (but infrequent) dry weather flow has been observed.
- Fecal coliform numbers are relatively high, and ammonia was near 1 mg/L (elevated ammonia reading).
- Several pipe ends in inlet boxes that we are unsure where they connect to…but sure look like “old” sanitary drain line pipes.
- Stagnant water in bottom of a basin…but when field review conducted, was during a very long dry period during this past summer.

LandStudies

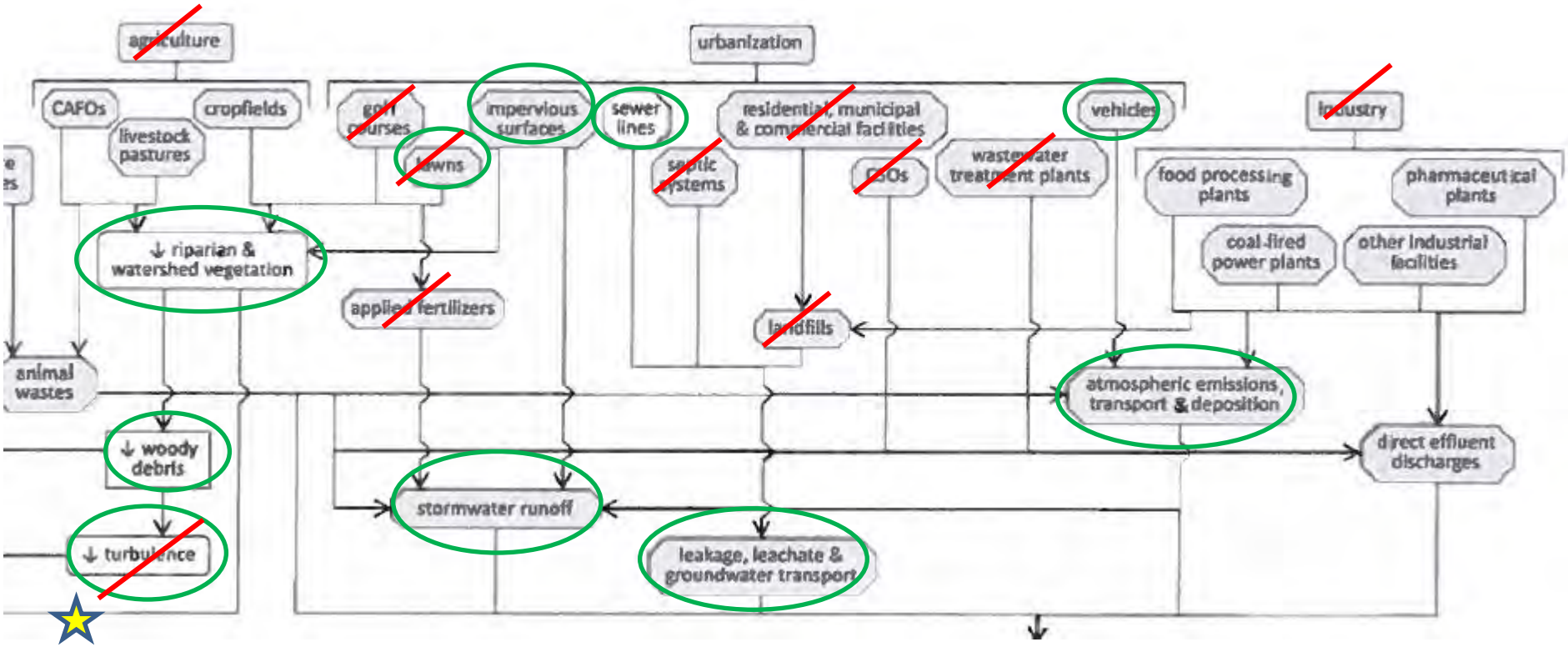


Revised conceptual model diagram for AMMONIA

EPA CADDIS


agriculture
urbanization
CAFOs
livestock pastures
cropfields
golf courses
impervious surfaces
sewer lines
residential, municipal & commercial facilities
vehicles
industry
lawns
septic systems
CSOs
wastewater treatment plants
food processing plants
pharmaceutical plants
coal-fired power plants
other industrial facilities
↓ riparian & watershed vegetation
applied fertilizers
landfills
animal wastes
atmospheric emissions, transport & deposition
↓ woody debris
direct effluent discharges
stormwater runoff
↓ turbulence
leakage, leachate & groundwater transport

EPA CADDIS



Sources that could not be eliminated when cross-referencing potential sources of fecal include impervious surfaces (where animal droppings, etc. are present), septic and/or sanitary/wastewater lines, and emissions/ atmospheric deposition.

So what in the world is happening within this system?

Outfall “029” – Next steps

- Sampling for *E. coli* to help determine if natural sources (unlikely) or sanitary/ wastewaster influences.
- Catch (“bucket method”) test of unknown pipe ends found in inlet basins at and just upstream of inlets with standing water.
- Other?

LandStudies

Outfall “029” – Wet weather sampling results

WET CHEMISTRY					
Ammonia-N	0.952		mg/L	0.100	D6919-09
Nitrate/Nitrite-N	1.1		mg/L	0.20	EPA 300.0
Phosphorus, Total	0.17		mg/L	0.10	EPA 365.1
Total Kjeldahl Nitrogen	ND		mg/L	1.0	S4500NH3G-11
Total Nitrogen	ND		mg/L	2.10	Calculation
Turbidity	19.1		NTU	0.10	S2130B-01
MICROBIOLOGY					
Fecal Coliform	220000	1	col/100mL	1	S9222D-97
Total Coliform	>2419.6 COL/100 ML		col/100mL	1	S9223B-04

LandStudies

Outfall Screening/Monitoring

Quality Control (QC)

Land Studies

Valid data?

2014 Stream Monitoring

Testing Location	Test	Jan.	Feb.	March	April	May	June	July
West Newport	Dissolved Oxygen (mg/l)	13.20	16.50	12.60	16.50	16.50	16.50	8.
	Nitrates (mg/l)	8.00	6.10	8.00	7.40	5.90	9.50	5.
	Phosphates (mg/l)	0.45	0.31	0.55	0.16	0.28	0.36	0.
	Turbidity (NTUs)	6	3	1	7	4	2	
	Air Temp (˚F)	28	32	32	56	66	81	
	Water Temp (˚F)	38	34	38	53	58	62	
Huber's Run (E. Newport Rd.)	Dissolved Oxygen (mg/l)	16.30	12.90	16.50	16.50	9.80	9.20	10.
	Nitrates (mg/l)	9.30	8.20	10.30	10.60	9.70	8.60	6.
	Phosphates (mg/l)	0.45	0.24	0.25	0.10	0.12	0.16	0.
	Turbidity (NTUs)	0	5	5	2	3	4	
	Air Temp (˚F)	34	31	34	59	64	82	
	Water Temp (˚F)	39	35	38	53	59	63	
Moore's Run (E. Newport Rd.)	Dissolved Oxygen (mg/l)	12.80	13.30	16.50	16.50	9.70	16.50	8.
	Nitrates (mg/l)	8.20	5.70	7.50	8.40	5.90	8.10	6.

LandStudies

MS4 Permit requirements

A. Where samples are collected and analyzed or measurements are taken under this General Permit, the permittee shall assure:

1. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. (25 Pa. Code § 92a.3(c) and 40 CFR § 122.41(j)(1))

2. Records of monitoring information shall include (25 Pa. Code § 92a.3(c) and 40 CFR § 122.41(j)(3)):

    a. The date, exact place, and time of sampling or measurements.
    b. The individual(s) who performed the sampling or measurements.
    c. The date(s) analyses were performed.
    d. The individual(s) who performed the analyses.
    e. The analytical techniques or methods used.
    f. The results of such analysis.

3. Monitoring must be conducted according to test procedures approved under 40 CFR Part 136 unless another method is required under 40 CFR Subchapters N or O. (25 Pa. Code § 92a.3(c) and 40 CFR § 122.41(j)(4))

EPA requirements (40 CFR Part 136)

§ 136.1 — Applicability.
§ 136.2 — Definitions.
§ 136.3 — Identification of test procedures.
§ 136.4 — Application for and approval of alternate test procedures for nationwide use.
§ 136.5 — Approval of alternate test procedures for limited use.
§ 136.6 — Method modifications and analytical requirements.
§ 136.7 — Quality assurance and quality control.

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EPA Requirements ("Protocol")

15.0 Monitoring (MS4 5.1)			

The operator must evaluate the program compliance, the appropriateness of identified BMPs, and progress towards achieving identified measurable goals. [40 CFR 122.34(g)]
 	
Note: The NPDES permitting authority may determine monitoring requirements for the operator in accordance with state/Tribal monitoring plans appropriate to the watershed. [40 CFR 122.34(g)(1)]
	When monitoring is conducted, verify in records:
	
	• Representative samples and measurements have been taken
	• It is conducted according to the test procedures approved under 40 CFR 136
	• Records include:
	  • Date, location, time of sampling
	  • Name of those performing sampling
	  • Date of analyses
	  • Name of those performing analyses
	  • Analytical techniques or methods used
	  • Results of analyses
	
	Verify monitoring results are reported on a Discharge Monitoring Report (DMR).
	
	If the MS4 discharges to a water for which a TMDL was approved, verify that any additional monitoring requirements were performed.
		☐
		☐
		☐
		☐
		☐	

EPA Requirements ("Protocol")

11.0 Discharges to Water Quality Impaired Waters (MS4 - 3.1)		
The operator must comply with any more stringent effluent limitations in the permit, including permit requirements that modify, or are in addition to, the minimum control measures based on an approved total maximum daily load (TMDL) or equivalent analysis. [40 CFR 122.34(e)(1)]	Determine if a waterbody to which the MS4 discharges has been designated as a 303(d) listed water or a TMDL has been developed for the waterbody. If discharging to an impaired water, verify the SWMP discusses: • How discharges of pollutants of concern will be controlled	☐ ☐

Note: Two continuous monitoring cycles must show that the WLAs or water quality standards are being met.

Quality Control Document

Quality Assurance Project Plan (QAPP)
East Petersburg Borough – MS4 SWMP
Discharge Monitoring Program QC
Lancaster County, Pennsylvania




QAPP (QA/QC Document for sampling and analysis)

LandStudies

QAPP

1.6 Special Training/Certification

ALS requires personnel training as described in their QA Manual. No special training is required to collect and transport samples to ALS other than proficiency in the EPA stream sampling protocols. However, previous collection experience is appropriate to demonstrate and meet the "qualified personnel" requirements of the CWA. A copy of the ALS laboratory certification can be found in the appendix.

Fecal Coliform

- One (1) 125 ml plastic container collected per site (provided by laboratory)
- Sample collected via unfiltered bottle collection method; sample transferred to bottle with preservative on site
- Preserved with $Na_2S_2O_3$

QAPP

- Sample collection
- Collectors wear disposable, powderless gloves
- Where applicable, in-stream bottle rinsing (minimum three (3) times) prior to unfiltered bottle collection (preservative is placed in applicable bottles prior to acquisition by the laboratory).
- Where applicable, a sample bottle rod will be used to “disconnect” the collector from the bottle and outfall to reduce probabilities associated with contamination.
- Field meters will be used for pH and temperature
- Bottles are collected in pre-labeled “coolers” with ice.
- Bottle labeling
- Information will be entered on the pre-attached bottle label upon immediate acquisition. Information includes:
  - Site location name (and ID number)
  - Analysis requested
  - Date & time of acquisition
  - Collector
  - Preservative (if applicable)
  - “East Petersburg Borough” is placed on every label
- Field Meters
  - For “In-stream” measurement
  - Field equipment is calibrated by East Petersburg Borough personnel immediately prior to mobilization into the field for sample acquisition.
- Field Documentation
- CoC Form
- Site Field Report

LandStudies

QAPP

2.4 Instrument/Equipment Testing

The pH/temperature meter will be calibrated at the field offices of East Petersburg Borough prior to the sample collection event. A "field test" will be conducted immediately following the calibration to ensure the equipment is providing reasonable measurements.

The instruments and equipment at ALS, Middletown, PA will be tested in accordance with ALS's QA Manual.

The checklist to be followed to verify and validate data is:

- Data organized into Excel spreadsheet (numeric values and concentration units)
- Data entry examined by original processor to ensure values match the lab report and borough field reports
- Review of data entered and individual Excel spreadsheet formulas will be completed by assigned representative
- A confirmation via email the data is valid.
- The QA Officer will review the data for comparative purposes (qualify the data) and to verify the data is valid.

ALS Environmental

34 Donwood Lane
Middletown, PA 17057
P. 717-944-5541
F. 717-944-1430

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT/ SAMPLER. INSTRUCTIONS ON THE BACK

Page 1 of 1

Courier:

Tracking #:

* 2 1 6 3 3 7 9 4 *

Co. Name: LANDSTUDIES

Contact (Report to): MIKE LASALA Phone: 717-627-4440

Address: 315 NORTH ST. LITITZ, PA 17543

Bill to (if different than Report to): PO#:

Project Name/#: LITITZ SWMP-MSA ALS Quote #: 5418CA

TAT: [X] Normal-Standard TAT is 10-12 business days; [ ] Rush-Subject to ALS approval and surcharges. Date Required: Approved By:

Email? [X] Y mike@landstudies.com

Fax? [ ] Y No:

Sample Description/Location (as it will appear on the lab report)	COC Comments	Sample Date	Military Time	*G or C	**Matrix	Enter Number of Containers Per Analysis								
~~[illegible]~~				G										
2 OUTFALL 016 (WET)		8/1	1440	G				1	✓	✓	✓	1	✓	
3 ~~[illegible]~~ LOCUST ST		8/1	1430	G		1	1							
4 ~~[illegible]~~ FRONT ST		8/1	1420	G		1	1							
5 OAK ST BRIDGE		8/1	1435	G		1	1							
6 OUTFALL 029		8/1	1445	G		1	1	1	✓	✓	✓	1	✓	
7 ~~[illegible]~~				G										
8 BOX OUTFALL		8/1	1505	G		1	1	1	✓	✓	✓	1	✓	

ANALYSES/METHOD REQUESTED

	Total Coliform	Fecal Coliform	PHOS, Total	Ammonia-N	TKN	Total Nitrogen	Nitrate/Nitrite	Turbidity
**Container Type	PL	PL	PL	PL	PL	PL	PL	PL
Container Size	125	125	1L	1L	1L	1L	500	500
Preservative			H2SO4				HNO3	

Cooler Temp: 4°C

Temp. Blank: 4.4

No. of Coolers:

Notes:

	Y	N	Circle appropriate Y or N
Custody seals present?		N	
Correct sample volume?		N	
Correct preservation?		N	
Headspace/Bubbles?		N	
COC/Labels complete/agree?		N	
Container in good condition?	Y		

SAMPLED BY (Please Print): MIKE LASALA

Project Comments: 8/1/16 2011 SB 8/5/16

Relinquished By / Company Name	Date	Time	Received By / Company Name	Date	Time
1 MIKE LASALA / LANDSTUDIES	8/1	1730	2 [signature]	8/1/16	1730
3			4		
5			6		
7			8		
9			10		

* Grab(G) Or Composite

Data Deliverables: [X] Standard; [ ] CLP-Like; [ ] NJ-Reduced; [ ] NJ-Full; [ ] other

EDDs Required: [ ] Yes, format type: Other

ERA Format: yes / no

State Samples Collected In: NY / PA [X]

COD Criteria Required?

ALS FIELD SERVICES: [ ] Pickup; [ ] Labor; [ ] Composite Sampling; [ ] Rental Equipment; [ ] Other

**Matrix: Air-Air; DW-Drinking Water; GW-Groundwater; OI-Oil; O-Other Liquid; SL-Sludge; SO-Soil; WP-Wipe; WW-Wastewater

**Container Type: AG-Amber Glass; CG-Clear Glass; PL-Plastic. Container Size: 250ml, 500ml, 1L, 4oz, etc. Preservative: HCl, HNO3, NaOH, etc.

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Rev 01-2013

Tuesday, August 16, 2016 1:50 PM

Page 1 of 1

Outfall Screening/Monitoring

Documentation & Assessments

Land Studies

Waterworks Pre-storm
Pleasant St Pre-storm
Strawberry St Pre-storm
Lyndon PS Pre-storm
Mill Creek Pre-storm
Millersville Pre-storm

Waterworks 3-6 Hour
Pleasant St 3-6 Hour
Strawberry St 3-6 Hour
Lyndon PS 3-6 Hour
Mill Creek 3-6 Hour
Millersville 3-6 Hour

Waterworks 6-12 Hour
Pleasant St 6-12 Hour
Strawberry St 6-12 Hour
Lyndon PS 6-12 Hour
Mill Creek 6-12 Hour
Millersville 6-12 Hour

Waterworks 24-48 Hour
Pleasant St 24-48 Hour
Strawberry St 24-48 Hour
Lyndon PS 24-48 Hour
Mill Creek 24-48 Hour
Millersville 24-28 Hour

Clay St. 1st Hour
Clay St. 2nd Hour
Clay St. 3rd Hour
Engleside 1st Hour
Engleside 2nd Hour
Engleside 3rd Hour
AWWTP Composite During

Location	Temperature °C	pH	Dissolved Oxygen (D.O) (mg/L)	Bis Phthalate (ug/L)	NH3-N (mg/L)	CBOD (mg/L)	TSS (mg/L)	Al (mg/L)	Cd (mg/L)	Cu (mg/L)	Pb (mg/L)	Hg (mg/L)	Zn (mg/L)	Fecal Coliform (col/100mL)
Waterworks Pre-storm	22.0	6.72	9.53	ND	ND	ND	6	0.066	ND	ND	ND	ND	0.0039	74
Pleasant St Pre-storm	22.3	6.91	12.52	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.003	29
Strawberry St Pre-storm	22.9	8.01	13.73	ND	ND	ND	8	ND	ND	ND	ND	ND	0.0033	69
Lyndon PS Pre-storm	23.4	7.34	11.75	ND	ND	ND	8	0.049	ND	ND	ND	ND	0.0093	45
Mill Creek Pre-storm	21.4	7.52	9.57	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0034	250
Millersville Pre-storm	23.5	8.64	13.06											

Location	Temperature °C	pH	Dissolved Oxygen (D.O) (mg/L)	Bis Phthalate (ug/L)	NH3-N (mg/L)	CBOD (mg/L)	TSS (mg/L)	Al (mg/L)	Cd (mg/L)	Cu (mg/L)	Pb (mg/L)	Hg (mg/L)	Zn (mg/L)	Fecal Coliform (col/100mL)
Clay St. 1st Hour	20.7	7.25	8.47	ND	0.711	8.1	19	0.13	ND	0.011	0.0037	ND	0.033	580,000
Clay St. 2nd Hour	20.7	7.66	8.52	ND	0.216	ND	ND	0.067	ND	ND	ND	ND	0.0052	5,800
Clay St. 3rd Hour	17.6	7.23	9.31	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005	3,800
Engleside 1st Hour	21.9	7.16	7.97	ND	0.311	7.4	5	0.13	ND	0.017	0.0063	ND	0.11	1,030,000
Engleside 2nd Hour	21.9	7.55	8.13	ND	0.126	7.1	11	0.13	ND	0.019	0.006	ND	0.11	691,000
Engleside 3rd. Hour	21.8	7.33	8.43	ND	ND	6.5	6	0.11	ND	0.02	0.0056	ND	0.094	370,000
AWWTP Composite During	21.8	6.92	8.63	ND	ND	8.5	200	0.29	ND	0.0096	ND	ND	0.034	8,820

Location	Temperature °C	pH	Dissolved Oxygen (D.O) (mg/L)	Bis Phthalate (ug/L)	NH3-N (mg/L)	CBOD (mg/L)	TSS (mg/L)	Al (mg/L)	Cd (mg/L)	Cu (mg/L)	Pb (mg/L)	Hg (mg/L)	Zn (mg/L)	Fecal Coliform (col/100mL)
Waterworks 3-6 Hour	20.9	7.61	7.25	ND	ND	ND	6	0.097	ND	ND	ND	ND	0.0037	280
Pleasant St 3-6 Hour	21.9	7.61	7.55	ND	0.101	2	8	0.12	ND	ND	ND	ND	0.0046	12,500
Strawberry St 3-6 Hour	22.2	7.99	7.67	ND	ND	ND	12	0.15	ND	ND	ND	ND	0.0035	380
Lyndon PS 3-6 Hour	22.1	7.48	7.64	ND	0.144	2.2	65	0.63	ND	0.0038	0.0028	ND	0.016	5,300
Mill Creek 3-6 Hour	21.4	8.01	8.55	ND	0.154	2.9	9	0.071	ND	ND	ND	ND	0.0034	600
Millersville 3-6 Hour	22.0	7.76	7.41											

Location	Temperature °C	pH	Dissolved Oxygen (D.O) (mg/L)	Bis Phthalate (ug/L)	NH3-N (mg/L)	CBOD (mg/L)	TSS (mg/L)	Al (mg/L)	Cd (mg/L)	Cu (mg/L)	Pb (mg/L)	Hg (mg/L)	Zn (mg/L)	Fecal Coliform (col/100mL)
Waterworks 6-12 Hour	21.3	7.71	8.36	ND	ND	ND	ND	0.057	ND	ND	ND	ND	0.004	380
Pleasant St 6-12 Hour	21.4	7.47	8.22	ND	ND	2.4	7	0.063	ND	ND	ND	ND	0.0039	5,400
Strawberry St 6-12 Hour	21.8	7.66	8.19	ND	ND	ND	7	0.065	ND	ND	ND	ND	0.0037	2,400
Lyndon PS 6-12 Hour	22.4	7.42	8.77	ND	0.608	4.2	14	0.15	ND	0.0044	0.0013	ND	0.014	280,000
Mill Creek 6-12 Hour	21.4	8.77	8.49	ND	0.607	ND	7	0.075	ND	ND	ND	ND	0.0037	560
Millersville 6-12 Hour	22.5	7.78	8.57											

Rain event parameters

LandStudies Inc. (LSI) was contracted by the City of Lancaster to complete stream surveys during two qualifying storm events. Qualifying storm events require the following prerequisites:

- 48-hour dry period
- Pre-storm sample acquisition a minimum of three (3) hours prior to event.
- Minimum of three (3) hours of CSO discharge to the Conestoga River
- CSO sample acquisition during the 1st, 2nd, & 3rd hour of overflow.
- Transfer of acquired samples to accredited laboratory.

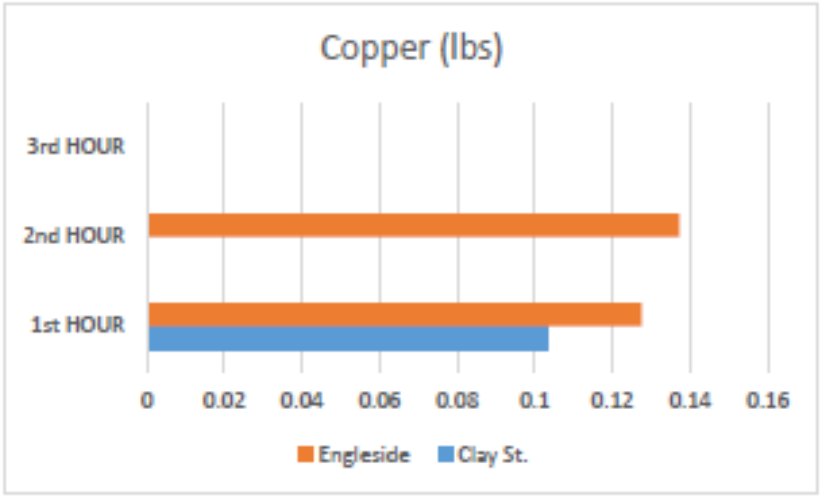
LandStudies

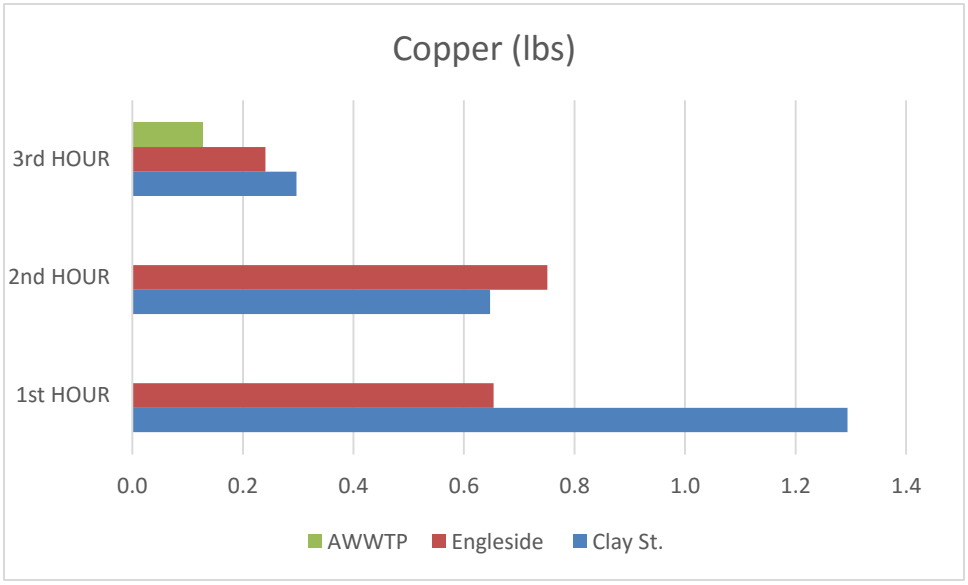
Monitoring Cycle (key points)

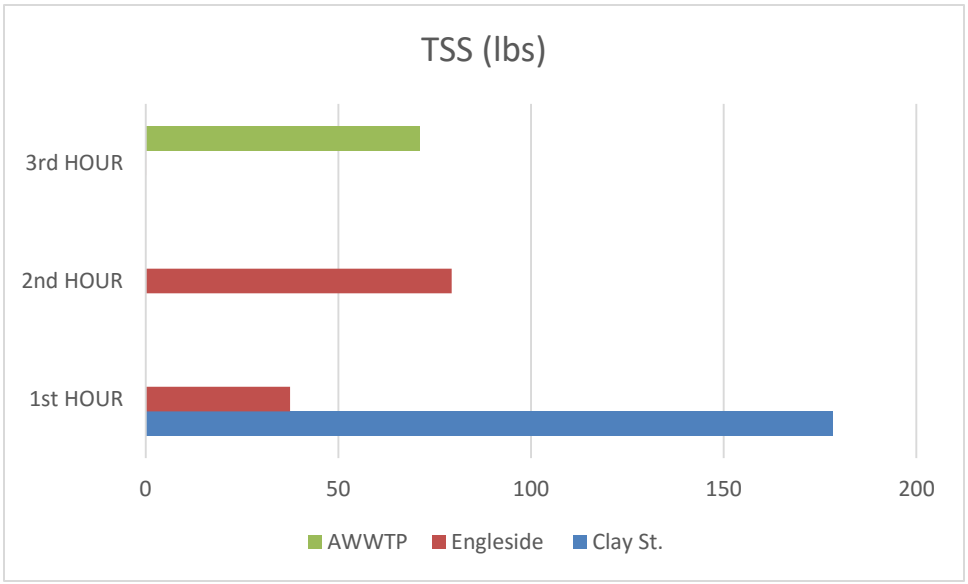
Multiple, “similar” events (at least two) per a single monitoring cycle.

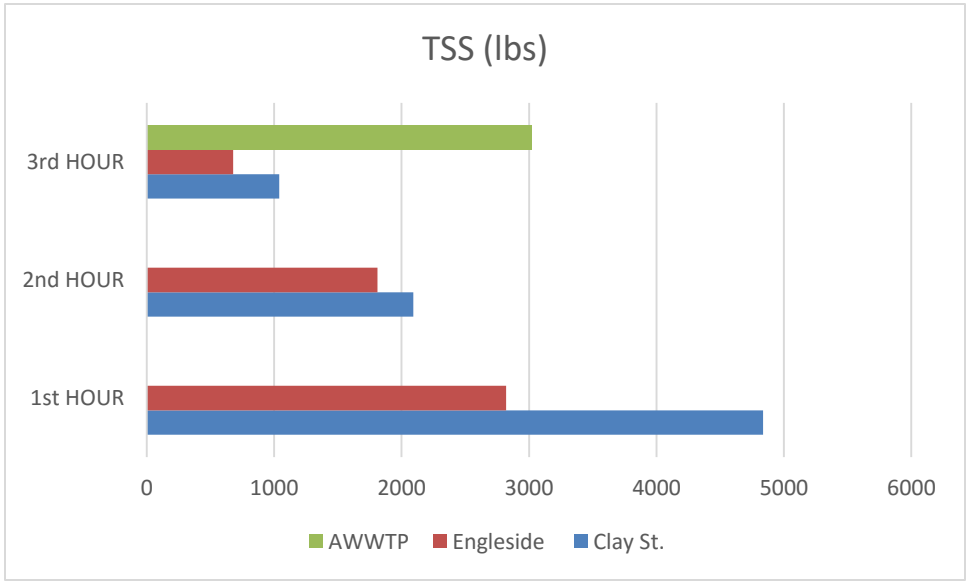
Multiple collections (at least two) during the event.

Ideal to sample stream points that straddle the outfalls to be sampled.


Copper (lbs)
3rd HOUR
2nd HOUR
1st HOUR
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
Engleside
Clay St.

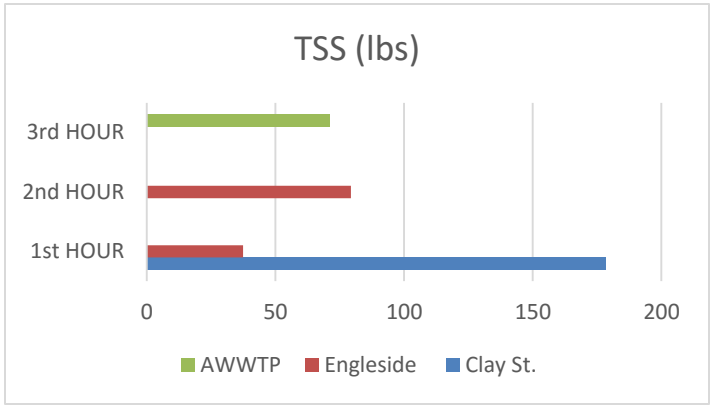

Copper (lbs)
3rd HOUR
2nd HOUR
1st HOUR
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
AWWTP
Engleside
Clay St.

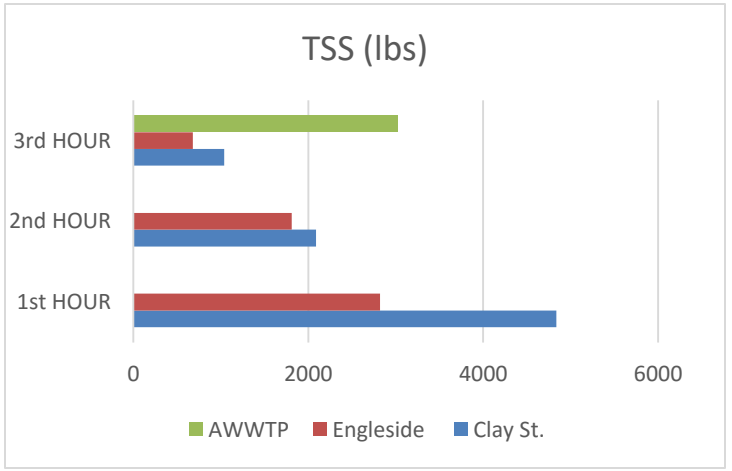

TSS (lbs)
3rd HOUR
2nd HOUR
1st HOUR
0
50
100
150
200
AWWTP
Engleside
Clay St.


TSS (lbs)
3rd HOUR
2nd HOUR
1st HOUR
0
1000
2000
3000
4000
5000
6000
AWWTP
Engleside
Clay St.

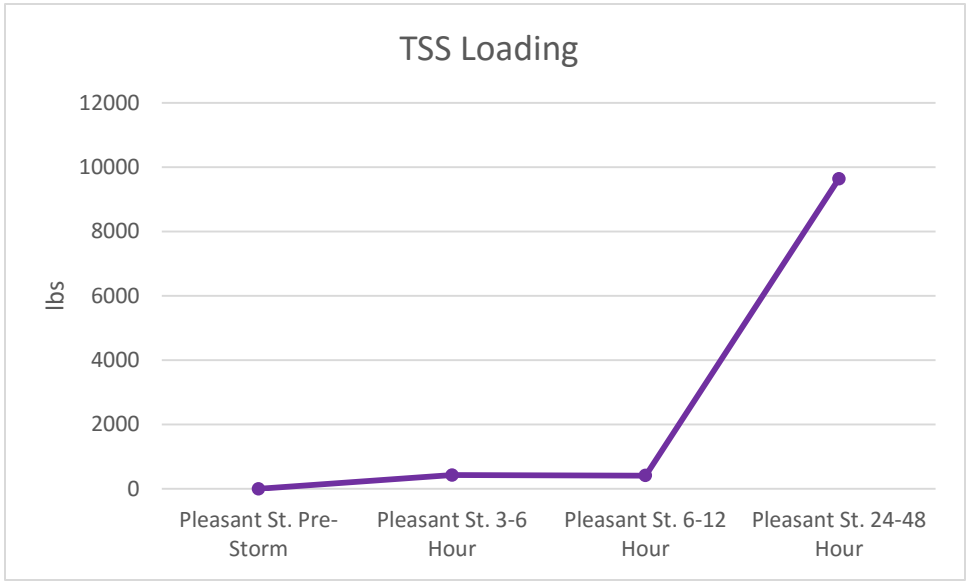
TSS (sediment) loading assessment of an MS3

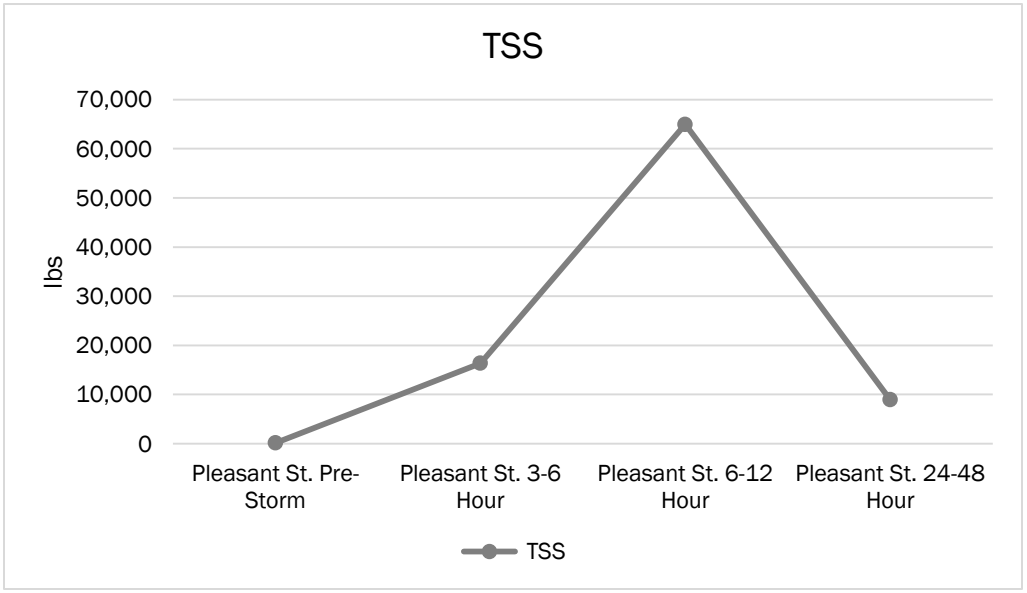
- Clay St MS3 is ~660 acres
- Storm 1 loading: ~0.26 lb/acre of sediment for ~3/8” of rain
- Storm 2 loading: ~12 lb/acre of sediment for ~2” of rain
- High number assessment
  - ~258 lbs/ac/yr
  - Based on 43” of rain/year
- Reality assessment (hybrid of the loadings from the two different storms)
  - ~144 lbs/ac/yr





LandStudies


TSS Loading
12000
10000
8000
6000
4000
2000
0
lbs
Pleasant St. Pre-Storm
Pleasant St. 3-6 Hour
Pleasant St. 6-12 Hour
Pleasant St. 24-48 Hour


TSS
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
lbs
Pleasant St. Pre-Storm
Pleasant St. 3-6 Hour
Pleasant St. 6-12 Hour
Pleasant St. 24-48 Hour
TSS

Flow meter alternatives

Fill a bottle method - If conducting an IC/ID investigation on an outfall, staff should record information on the diameter of an outfall for the determination of the discharge flow. The rate can be determined by measuring the length of time it takes to fill a 1-Liter bottle. This method is very helpful for low-flow situations.

Velocity-area method - The most practical method for measuring the discharge of a stream is the velocity-area method. This method requires the physical measurement of the cross-sectional area and the velocity of the flowing water. Discharge is determined as the product of the area times the velocity.

Discharge (ft^3/sec) = Velocity (ft/sec) x Depth (ft) x Width (ft)

Characterizing discharges & subsequent sampling

When conducting initial wet weather discharge characterization… okay to grab one sample.

Ideal to grab a first flush (or within first hour) of a rain event to characterize the nature of the discharge.

When developing monitoring cycles:

- Align event types to allow appropriate assessment of data
- Grab more than one data set within a single event (e.g. first flush and at least one hour later)

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Checklist revisited

- System Map ✓
- Determining Priority Areas ✓
- Enforcement Procedures & Actions (incl. ordinance) ✓
- Detecting illicit discharges ✓
- Tracing a source of an illicit discharge ✓
- Removing a source of an illicit discharge ✓
- Evaluation and assessment ✓
- Education ✓

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Outfall Screening/Monitoring

Program Goals Support

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Program Goals

Wet weather monitoring/sampling provides one of the strongest sets of supporting data for program goals and overall program focus areas.

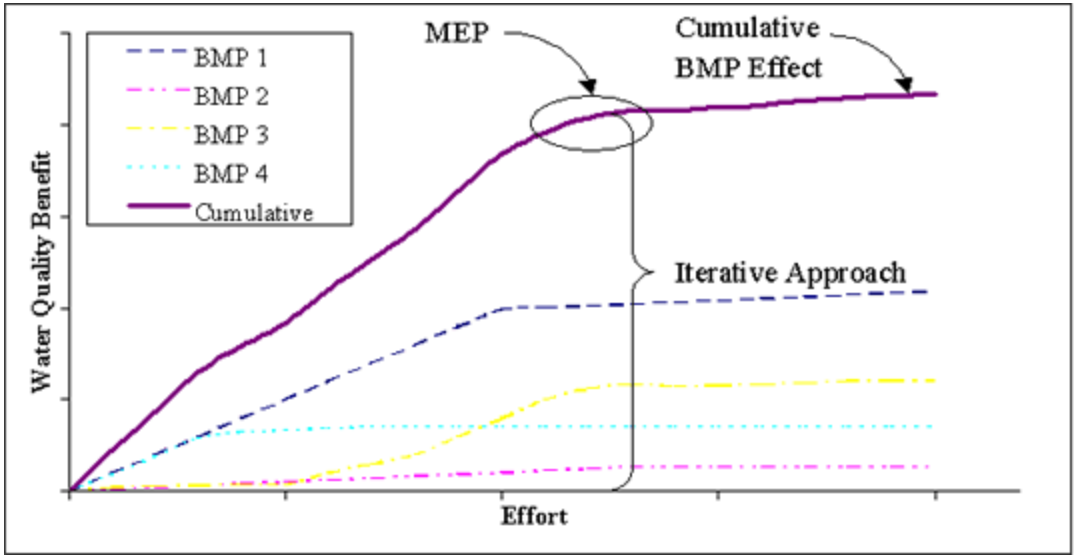
Note on inspections

Observation 6: At the time of the inspection, [redacted] did not distribute educational materials to all developers.

NOTE: This observation can be used to describe an example in a better fashion of what the developed SWMP is designed to do (and how the program is all tied together (the MCMs support each other directly))…the borough is responsible to distribute educational materials (to developers in this case). While saying distributing educational materials to all developers could be considered a measureable goal, it is not a goal that can be used to measure effectiveness. **Goals of a program are required to be able to be measured for effectiveness per the permit and regulations.** As an example, if the materials distributed (under MCM #1) are regarding proper maintenance of erosion and sediment control devices on a construction site, then the results of inspections under MCM #4 and/or monitoring data associated with discharges will determine if the BMP is effective or not. The measurable goal would be something along the lines of "all erosion and sediment control devices on sites are maintained as required/necessary." If these materials are distributed, and almost all developers are not maintaining erosions and sediment control devices as documented through inspections or as a result of smapling…then the educational materials distribution is not effective, and the approach needs modified (iterative process).

Maximum Extent Practicable (MEP)

It is recognized that "pollutant reductions that represent MEP may be different for each small MS4, given the unique local hydrologic and geologic concerns that may exist and the differing possible pollutant control strategies. Therefore, each permittee will determine appropriate BMPs to satisfy each of the six minimum control measures through an evaluative process" (Federal Register, Volume 64, No. 235, page 68754, December 8, 1999.).



Source: CA.gov

The preamble to the Federal Register states: "EPA has intentionally not provided a precise definition of MEP to allow maximum flexibility in MS4 permitting. MS4s need the flexibility to optimize reductions in storm water pollutants on a location-by-location basis…"

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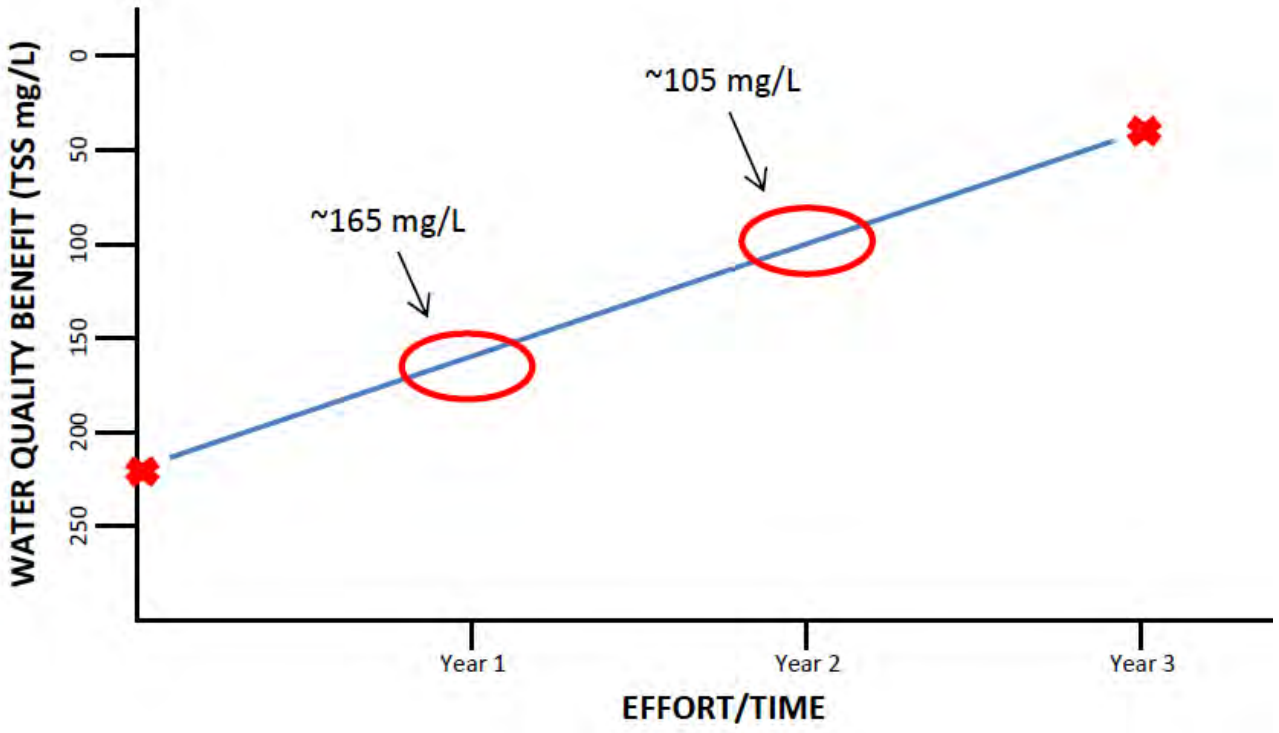
SWMP Goal – Summary (example)

Primary “tools” selected to support SWMP goal:

- BMP #1: Street sweeping under MCM 6
- BMP #2: System maintenance under MCM 6
- BMP #3: Public outreach and corresponding homeowner “improvements” under MCMs 1&2
- BMP #4: maintained basin under MCM 5



Final Thoughts and Questions?

Michael T. LaSala, CPMSM
mike@landstudies.com
717-627-4440

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