Source Tracking Methods and Resources Needed

Green Country Stormwater Alliance

Nienhuis Park Community Center
Broken Arrow
June 12, 2017

Outfall Reconnaissance

- The best time to perform an Outfall Reconnaissance Inventory (ORI) is when flow and leaf cover is minimal. These conditions allow a better view of the surrounding landscape and make illicit dry weather discharges easier to detect.
- Fill out an ORI each time an outfall is visited.


Where Is This Flow Coming From?

What Do We Do When We Find Flow?

- Evaluate the site. Look around and see if the source is obvious. If so, investigate. Question individuals around the site. They might provide you with clues that can save time. Whatever you do, make sure you are properly protected at all times, take pictures and collect samples for analysis if you think it *might* be beneficial.

Section 1: Site Information

Site Information		
Outfall ID:	**Date:**	**Time:**
Latitude (N):	**Longitude (W):**	
Investigators:		
Dominant Watershed Land Use (1=Primary use, 2=Secondary use): **□ Suburban Residential □ Industrial □ Open Space** **□ Urban Residential □ Commercial □ Other:**		
Receiving Stream:		
Access Instructions:		

Section 2: Outfall/Conveyance

Outfall/Conveyance		
Type	**Material**	**Shape**
☐ Closed Pipe ☐ Box Culvert Dimensions:	☐ Concrete ☐ Poly ☐ Steel ☐ Other	☐ Single ☐ Double ☐ Triple
☐ Open Channel Width: Top_____ Bottom _____	☐ Earthen ☐ Rip-rap ☐ Concrete	☐ Rectangle ☐ Parabolic ☐ Trapezoid
☐ Manhole ☐ Catch Basin ☐ Natural Flowage/ Creek ☐ Other:		

Section 3: Flow Estimation

Flow Estimation	
Flow Present: ☐ Yes ☐ No **Standing Water Present: ☐ Yes ☐ No**	
Amount: **☐ Trickle ☐ Moderate ☐ Substantial**	**Estimated Flow:**
Width At Water Surface:	**Depth Of Water:**
Approximate Flow Velocity:	**Calculated Flow Rate:**

Section 4: Environmental Conditions

Environmental Conditions		
Cloud Cover (%):	**Air Temp. (°C):**	**Wind:**
Last Rain Event: □ **<48 Hours** □ **48 to 72 Hours** □ **>72 Hours** **Amount:**		

Section 5: Analytical Results

Analytical Results			
Samples Collected From: □ Flow □ Pool Date: Time: Initials:			
Parameter	**Results**	**Parameter**	**Results**
Water Temperature	°C	Color	Color Units
pH	s.u.	Copper	mg/l
Conductivity	µmhos/cm	Detergents	mg/l
Dissolved Oxygen	mg/l	Fluoride	mg/l
Dissolved Oxygen	% Sat.	Hardness	mg/l
Ammonia	mg/l	Phenols	mg/l
Chlorine	mg/l	Turbidity	NTU
Were Samples Collected For The Laboratory: □ Yes □ No			

Section 6: Outfall Physical Indicators

Outfall Physical Indicators (F=Flow, P=Pool)				
Indicator	**Description**	**Relative Severity**		
Odor	☐ None ☐ Sewage ☐ Rancid/sour ☐ Oil/Gas ☐ Sulfide ☐ Chlorine ☐ Solvents ☐ Other	☐ Faint	☐ Easily Detected	☐ Noticeable from a distance
Color	☐ Clear ☐ Gray ☐ Green ☐ Red ☐ Brown ☐ Yellow ☐ Orange ☐ Other	☐ Faint Color In Sample Bottle	☐ Clearly Visible In Sample Bottle	☐ Clearly Visible In Outfall Flow
Particles	☐ None ☐ Fine ☐ Medium ☐ Large	☐ Slight	☐ Moderate	☐ Heavy
Floatables	☐ None ☐ Sewage ☐ Oil ☐ Foam ☐ Litter ☐ Other:	☐ Slight	☐ Moderate	☐ Heavy
Algae & Bacteria	☐ None ☐ Green ☐ Brown ☐ Orange	☐ Slight	☐ Moderate	☐ Excessive
Biology	☐ None ☐ Insects ☐ Mollusks ☐ Amphibians ☐ Reptiles ☐ Fish ☐ Mosquito Larvae Comments:			
Outfall Damage	☐ Normal ☐ Apparent Damage	**Describe:**		

Section 7: Illicit Discharge Concerns

Illicit Discharge Concerns (Non-Stormwater Flow Indicators)
☐ No Obvious Illicit Discharge ☐ Possible Illicit Discharge ☐ Obvious Illicit Discharge

Comments:
_____ _____ _____ _____ _____ _____ _____

Illicit Discharge Hotline Incident Tracking Sheet

- Callers should be able to remain anonymous if they desire. This encourages reporting. Assign a unique "Incident ID" to each call so the caller can track the status of the investigation if they desire. It shows the caller that their call was taken seriously and their concerns are being addressed.
- Note when the call was taken and when the alleged incident occurred, both dates and times. The amount of precipitation in the last 24 hours is also an important detail.
- Try to be as precise as possible about the incident location.

Illicit Discharge Hotline Incident Tracking Sheet

- Without being "pushy" get as much information from the caller as you can. You may not get another chance to talk to them. Ask open-ended questions and let them fill in the blanks. You will get more information this way. "Yes or No" questions and "choose one of the following" limit their response and they might not provide all of the detailed information they have.
- Respond to calls as quickly as you can. Remember, the evidence is getting away.

Illicit Discharge Hotline Incident Tracking Sheet

Illicit Discharge Hotline Incident Tracking Sheet			
Incident ID:			
Responder Information			
Call Taken By:		**Call Date:**	
Call Time:	**Precipitation (inches) in past 24-48 Hours:**		
Reporter Information			
Incident Time:		**Incident Date:**	
Caller Contact Information *(Optional)*:			

Incident Location ***(Complete One or More Below)***			
Latitude and Longitude:			
Stream Location or Outfall #:			
Closest Street Address:			
Nearby Landmark:			
Location Description			
☐ **Stream Corridor (In or adjacent to stream)**	☐ **Outfall**	☐ **In-stream Flow**	☐ **Along Banks**
☐ **Upland Area (Land not adjacent to stream)**	☐ **Near Storm Drain**	☐ **Near Other Water Source (Pond, wetland, etc.)**	
Narrative Description of Location:			

Modified From: Illicit Discharge Detection and Elimination: A Guidance Manual (Center for Watershed Protection & Robert Pitt, University of Alabama)

Illicit Discharge Hotline Incident Tracking Sheet

Upland Problem Description			
☐ **Dumping**	☐ **Oil/Solvents/Chemicals**	☐ **Sewage**	
☐ **Wash Water, Suds, etc.**	☐ **Other:**		
Stream Corridor Problem Description			
Odor	☐ **None**	☐ **Sewage**	☐ **Rancid/Sour**	☐ **Petroleum** (gas)
	☐ **Sulfide (rotten eggs); Natural Gas**	☐ **Other: Describe in "Narrative Section"**		
Appearance	☐ **Normal**	☐ **Oil Sheen**	☐ **Cloudy**	☐ **Suds**
	☐ **Other: Describe in "Narrative" Section**			
Floatables	☐ **None**	☐ **Sewage** (toilet paper, etc.)	☐ **Algae**	☐ **Dead Fish**
	☐ **Other: Describe in "Narrative" Section**			
Narrative Description of Problem Indicators:				
Suspected Violator (name, personal or vehicle description, license plate #, etc.):				

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Illicit Discharge Hotline Incident Tracking Sheet

Investigation Notes	
Initial Investigation Date:	**Investigators:**
☐ **No Investigation Made**	**Reason:**
☐ **Referred to Different Department/Agency**	**Department/Agency:**
☐ **Investigated: No Action Necessary**	
☐ **Investigated: Requires Action**	**Description of Actions:**
Hours Between Call and Investigation:	**Time Required to Close Incident:**
Date Case Closed:	
Notes:	

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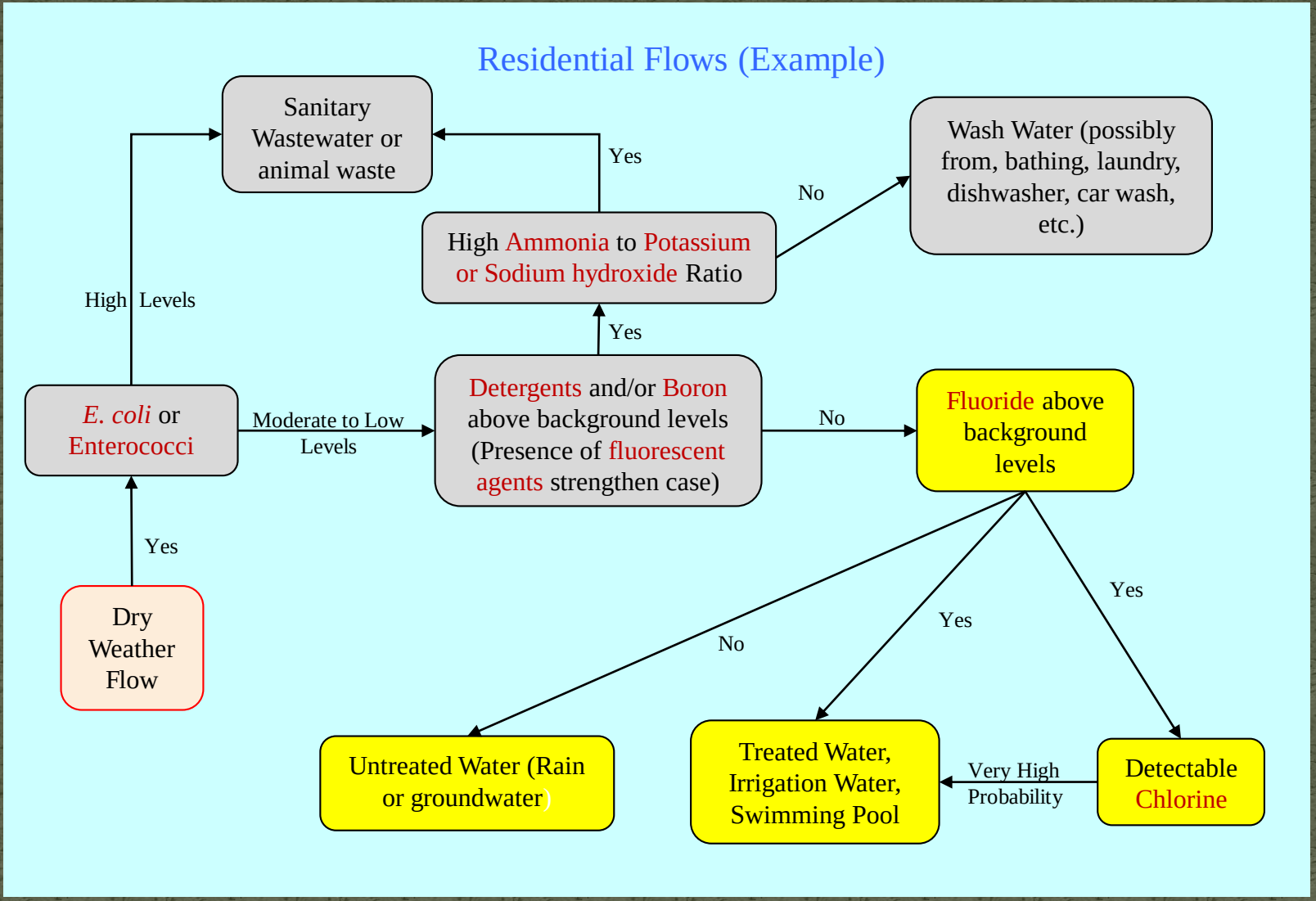
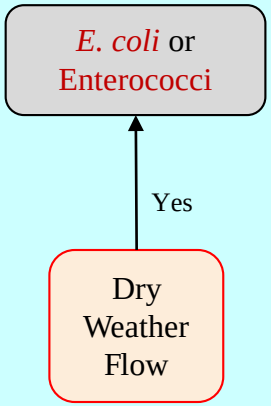
Residential Source Tracking Example



This is a hypothetical example of how we might approach the discovery of a dry weather flow and use the preponderance of evidence.

Residential Source Tracking Example

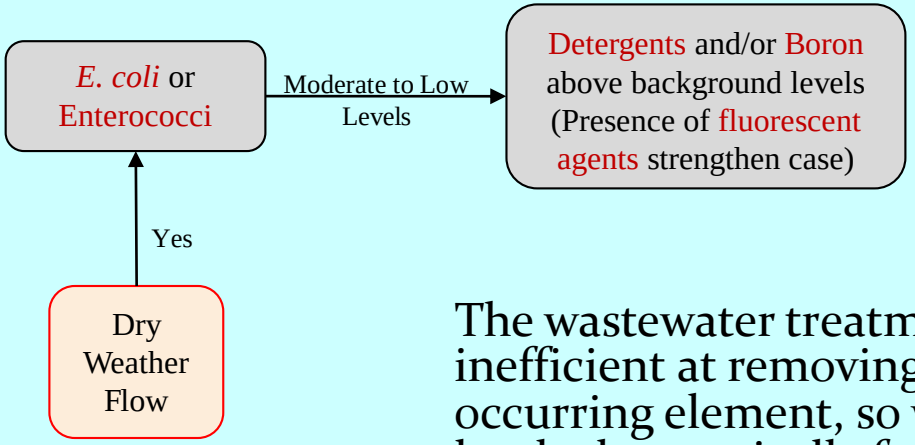
Residential Flows (Example)



Test for *E. coli* and Enterococci to see if these bacteria levels are characteristic of the local influent or effluent sanitary wastewater. If they match, suspect sanitary wastewater. Remember, if the sanitary wastewater is mixing with other sources, it will be diluted, so don't rule out lower levels. Fecal material entering the sub-watershed from animals can complicate things.

Residential Source Tracking Example

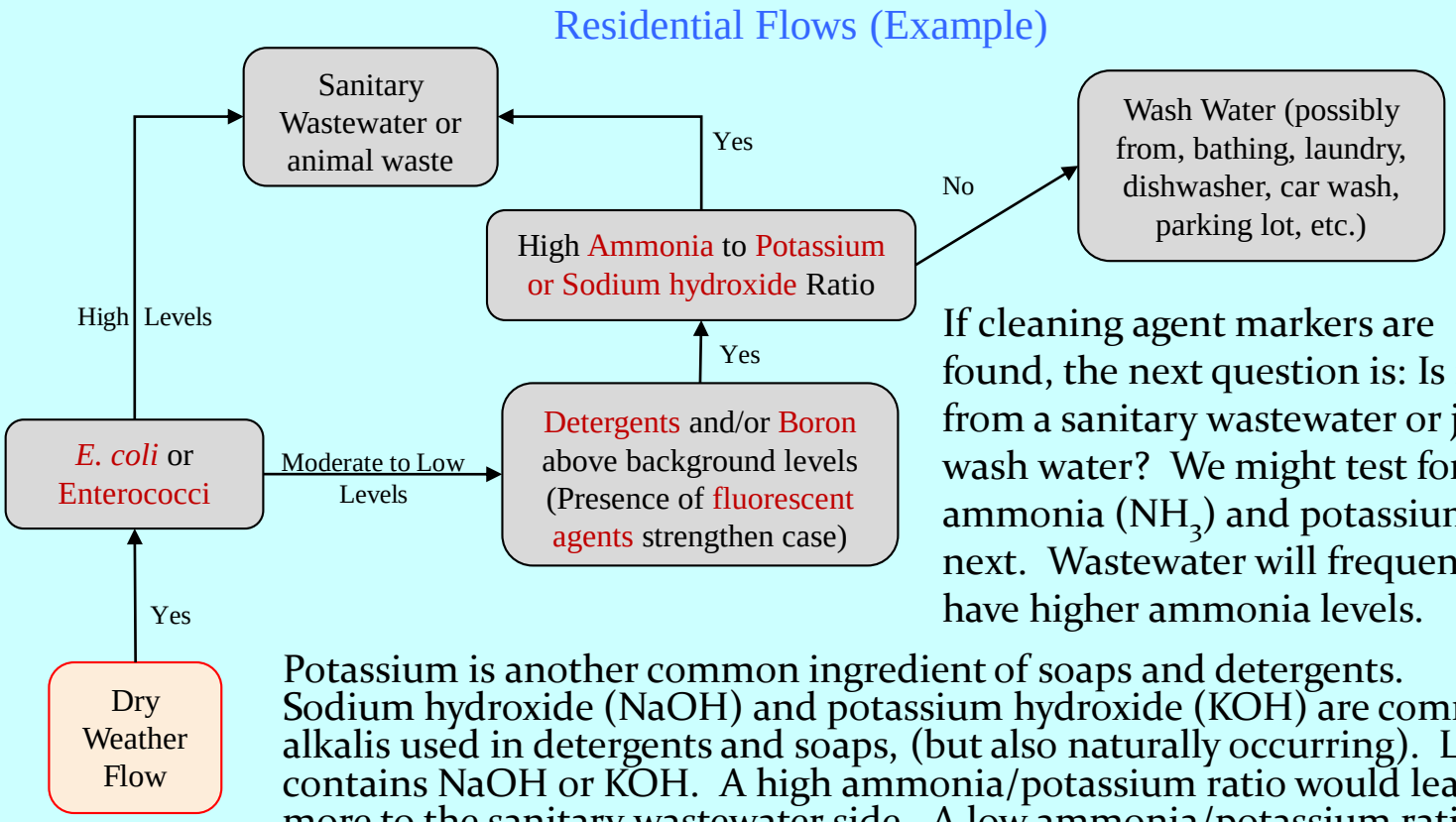
If the bacteria levels are moderate to low, test for detergent indicators. MBAS (methylene blue active substances) is a test for synthetic or organic surfactants (derived from petroleum). They are used in industrial and residential detergents and soaps and lower the surface tension of water to allow dirt and grease to be more easily washed off. The MBAS test is prone to positive interferences, but can be used as an indicator of a component commonly found in detergents.



Also test for boron (B) which is commonly found in soaps and detergents (Borax), although concentrations can vary widely.

The wastewater treatment process is quite inefficient at removing boron. Boron is a naturally occurring element, so we are looking for higher levels than typically found in local waters. Finally, the presence of fluorescent agents, which are commonly found in soaps and detergents will help build a stronger case for cleaning agents.

Residential Source Tracking Example

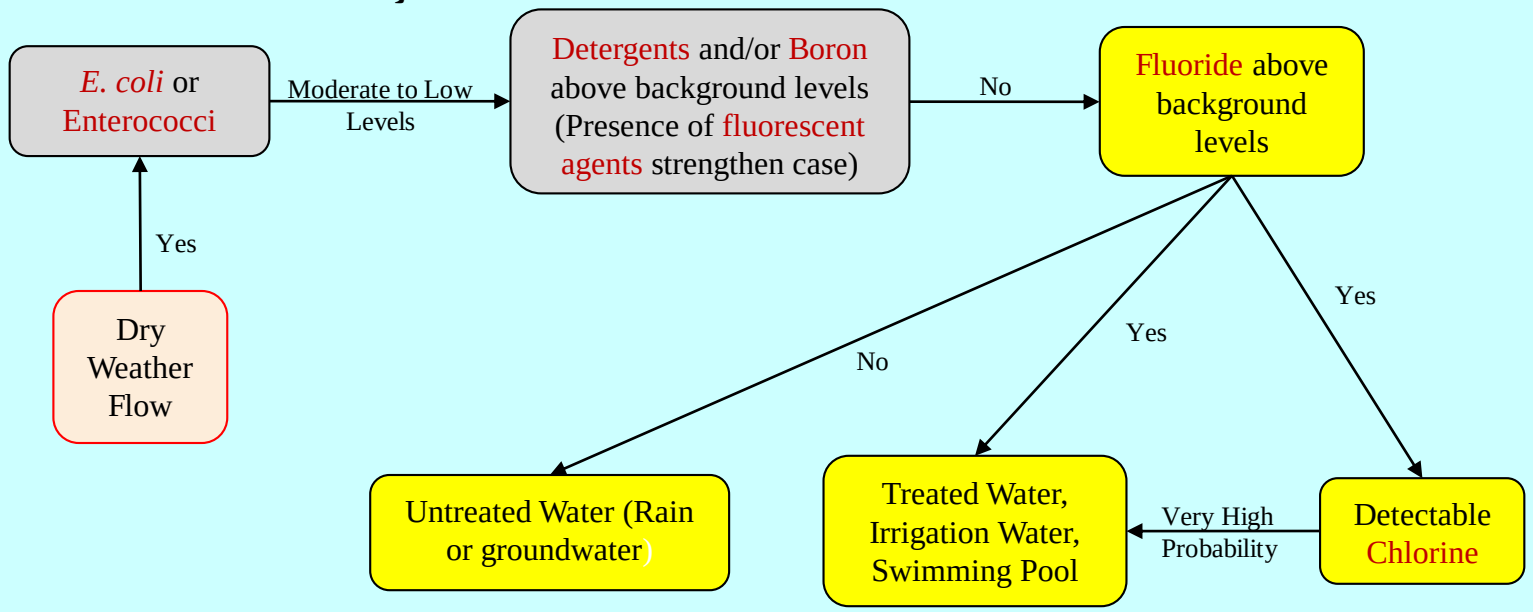


If cleaning agent markers are found, the next question is: Is it from a sanitary wastewater or just a wash water? We might test for ammonia (NH_3) and potassium (K) next. Wastewater will frequently have higher ammonia levels.

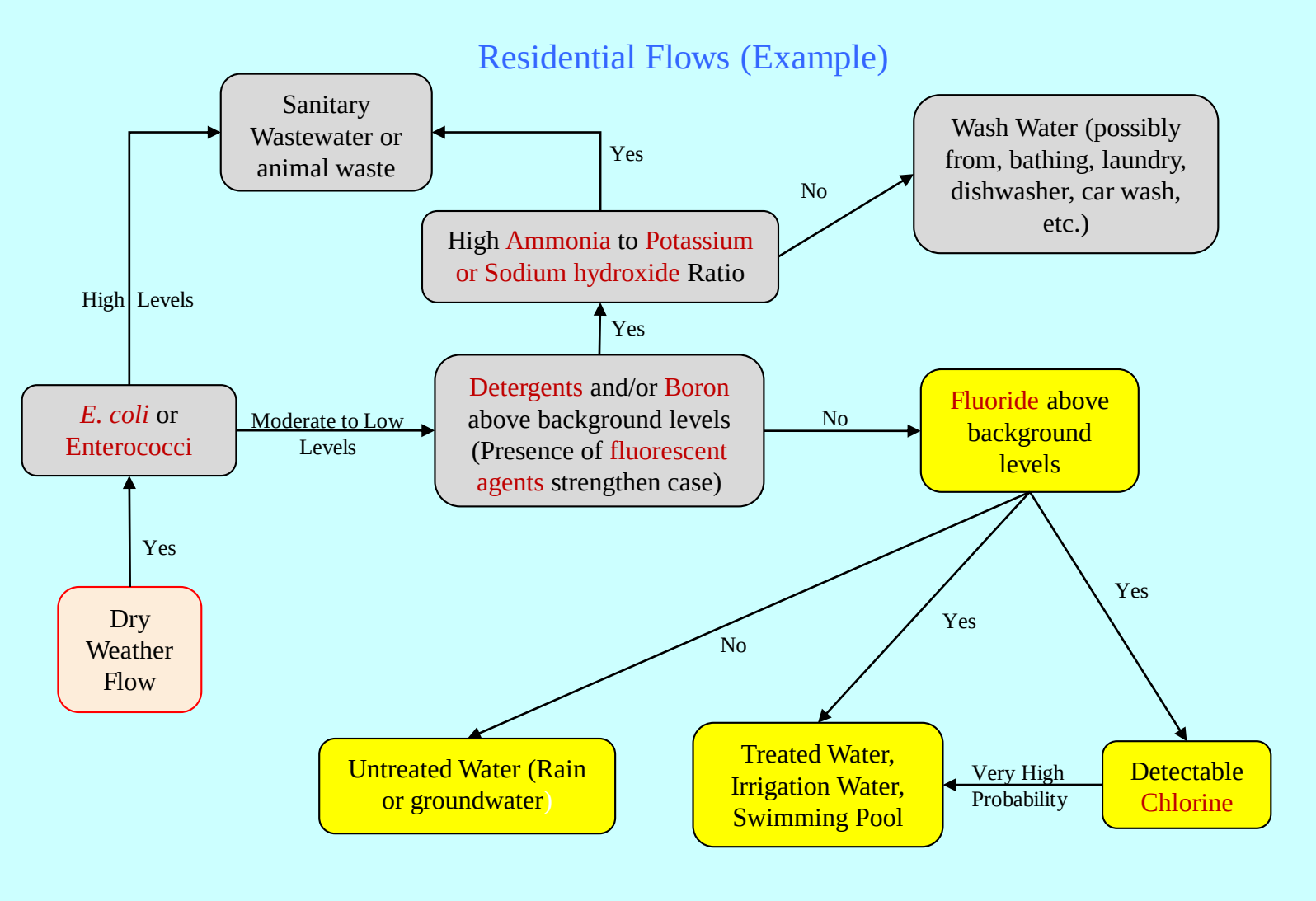
Potassium is another common ingredient of soaps and detergents. Sodium hydroxide (NaOH) and potassium hydroxide (KOH) are common alkalis used in detergents and soaps, (but also naturally occurring). Lye contains NaOH or KOH. A high ammonia/potassium ratio would lead us more to the sanitary wastewater side. A low ammonia/potassium ration would leave us thinking we are more likely dealing with a wash water. Keep in mind not all wastewater will have high ammonia levels and not all cleaners will contain potassium.

Residential Source Tracking Example

If significant concentrations of cleaning agent markers are not found. How about fluoride? Treated waters will usually have fluoride levels higher than commonly found in groundwater. If elevated fluoride levels are found, test for the presence of chlorine. If chlorine is detected along with high levels of fluoride, we can be pretty certain we are dealing with a treated water. Chlorine is volatile, so will quickly disappear. Therefore, the lack of chlorine does not rule out a treated water. Detection levels and interference can present a problem when analyzing for fluoride, so the lack of fluoride does not necessarily rule out a treated water.



Residential Source Tracking Example



Residential Source Tracking Example

- All of these markers may dissipate as the water flows through the soil and underground, which will complicate our job. Variations in concentration are expected. We are looking for indicators at levels not commonly found in that area, above background levels. Relying on only one indicator is less certain than using the weight of evidence if multiple indicators can be used.

- This process isn't perfect, but better than just a wild guess. Consider other factors in this process as well. Don't forget, we can get additional clues from the color, smell, types of particles in the flow, etc. Use all of your senses (except taste), consider the surrounding land uses and do your best.

Deposits, Stains and Vegetation

Deposits, stains and vegetation may indicate previous discharges or intermittent flows.

Dry Weather Flow

This outfall was flowing during a dry weather time and when walked back, was runoff from a splash pad.

Dry Weather Flow

This is a permitted discharge discovered during a dry weather field screening event.

Concrete Stain

This stain is on a sidewalk.
Hmm?

Concrete Stain

And the stain led back to this outlet.

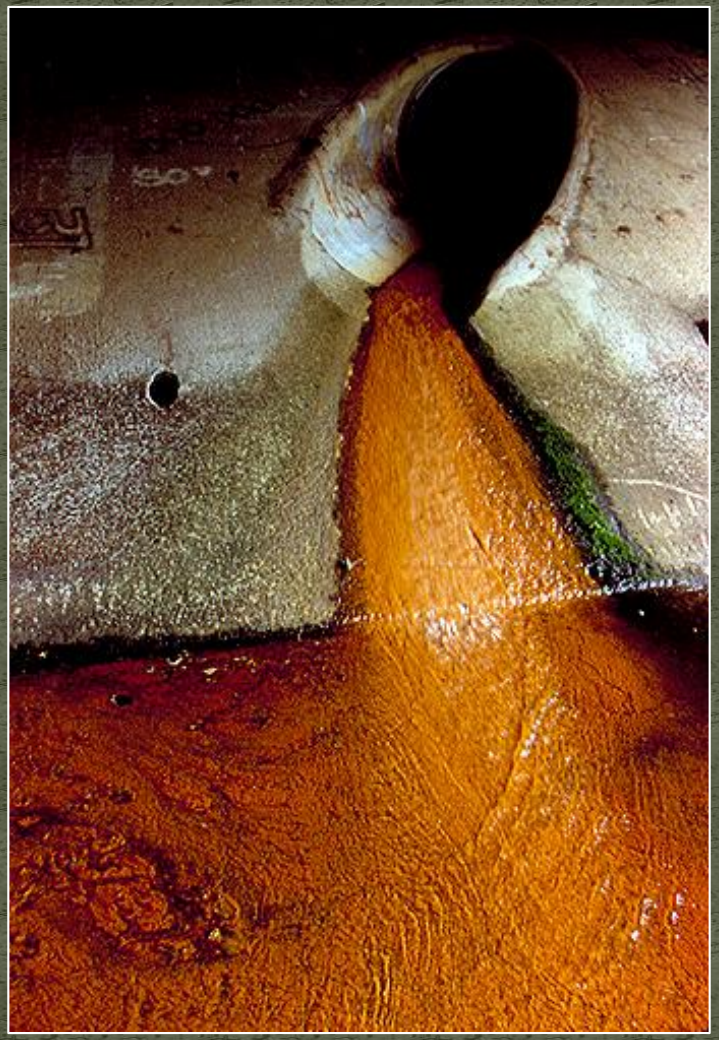
Concrete Stain

Looks like a copper stain.

Upon further investigation, this building has a partial copper roof.

Deposits and Stains

Is there anything recognizable in the deposit or can it be scraped off for analysis?



Deposits and Stains

We have deposits and staining, but what is causing it?

Is the stain coming from the water in the pipe?

A close inspection reveals the stain doesn't extend all the way up to the pipe. It appears to be originating from cracks in the concrete.

Deposits and Stains

We have deposits and staining, but what is causing it?

Another discharge into this same box culvert also has some staining, but closer inspection reveals re-bar close to the surface and actually exposed.

Could those stains be iron deposits from the re-bar in the concrete and not related to the chemistry of the water in the pipe?

Questions?

Until man duplicates a blade of grass, nature can laugh at his so-called scientific knowledge.
Thomas Edison