

# North Central Texas Watershed Stakeholder Meeting

Staff Contact: Elena Berg



North Central Texas Council of Governments

Environment  
& Development

[www.nctcog.org/WaterResources](http://www.nctcog.org/WaterResources)

The background features abstract, overlapping geometric shapes in various shades of blue, ranging from light sky blue to deep navy blue. These shapes are primarily located on the left and right sides of the frame, creating a modern, dynamic feel. The central area is a clean, white space.

Welcome!



Trinity River Authority of Texas  
*Enriching the Trinity basin as a resource for Texans*

# Testing for Optical Brighteners: The Good, The Bad, and The Sludgy

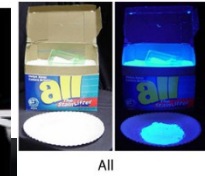
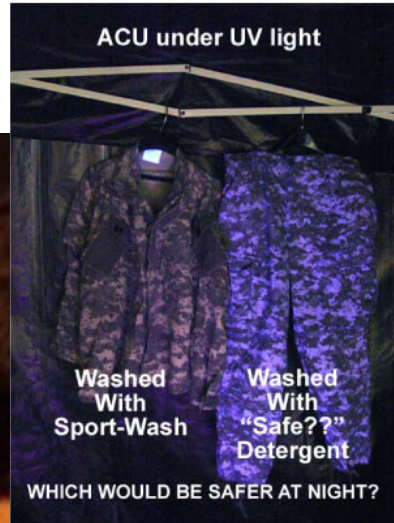
Aaron Hoff  
Trinity River Authority  
June 25, 2019

Wastewater Treatment ▪ Water Treatment ▪ Water Storage ▪ Lake Livingston ▪ Recreation



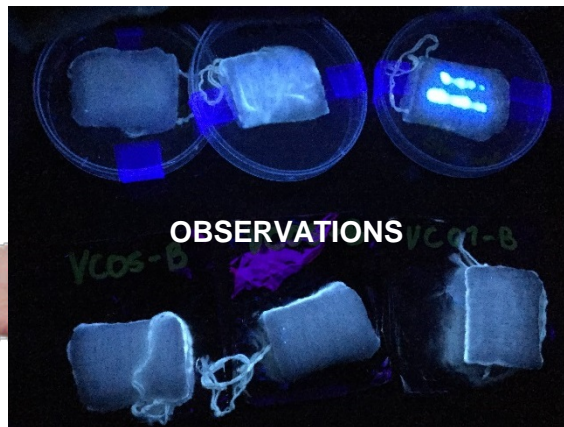
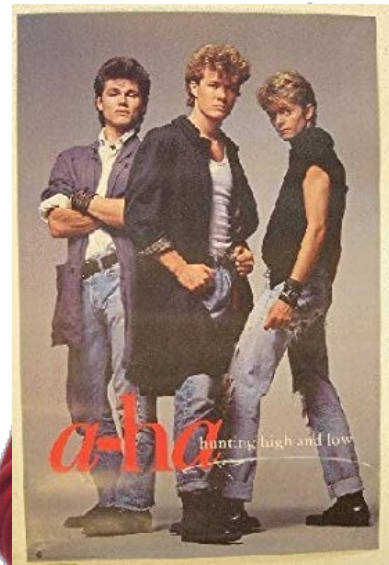
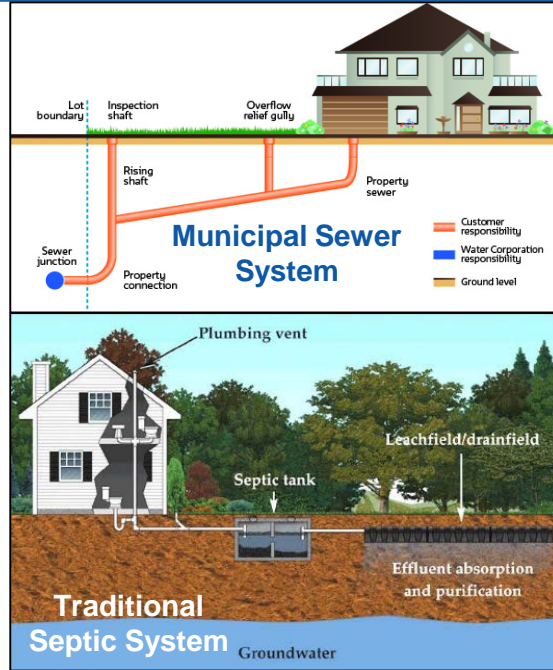


# Optical Brighteners?



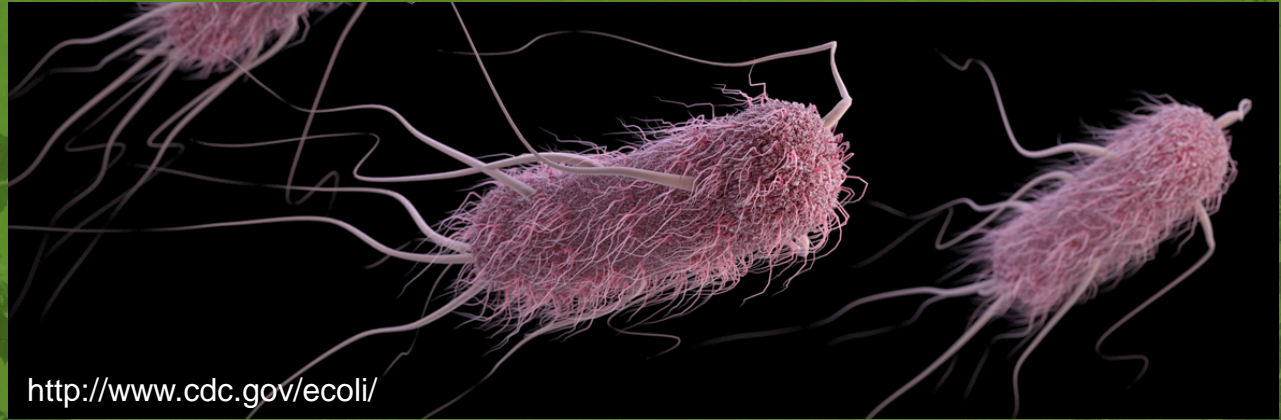


# This relates to water pollution...how?





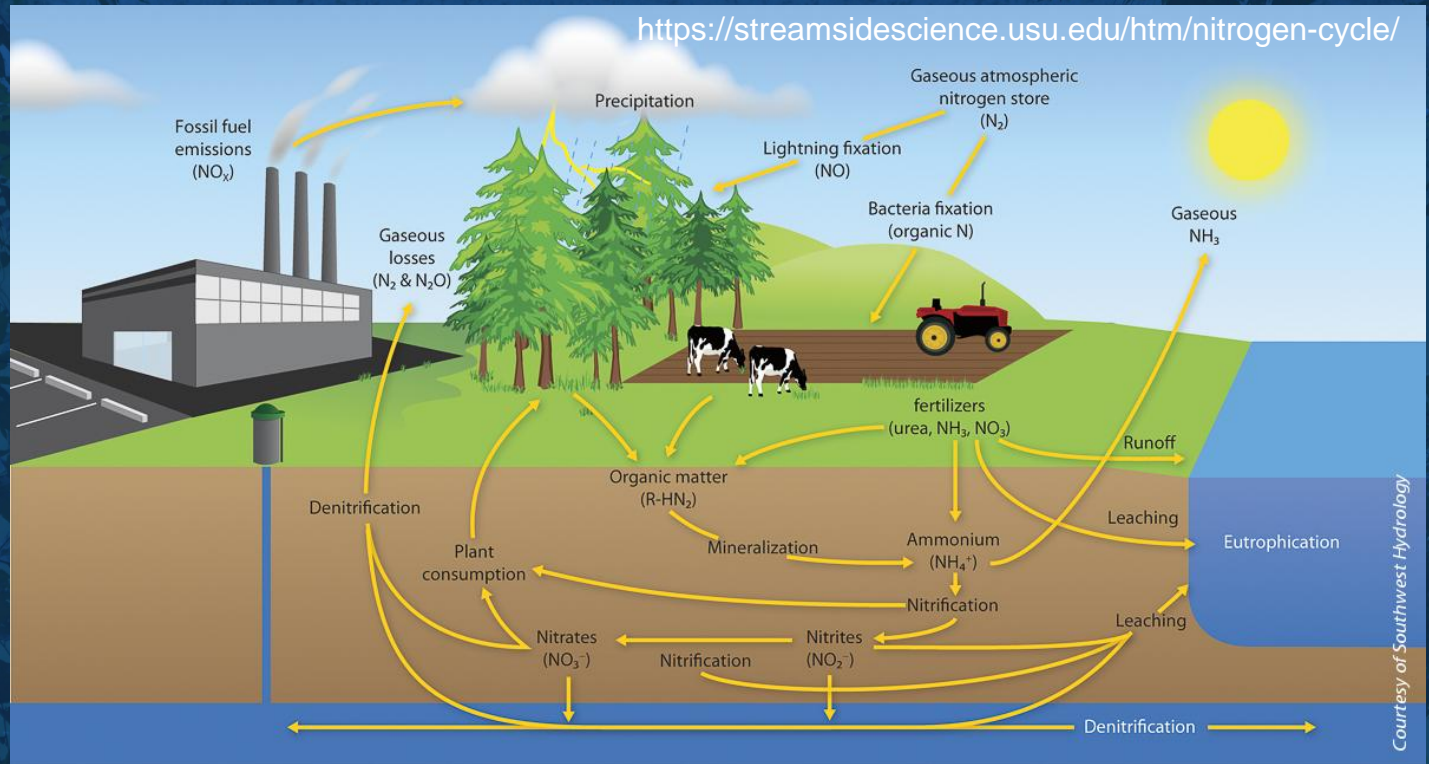
# *Escherichia coli* (*E. coli*)



- TCEQ standard for primary contact recreation waterbodies: 126 cfu/100 mL
- Found in intestines of warm-blooded animals
- Most strains are harmless
- Used as indicator bacteria for other potentially harmful species/strains that may be present



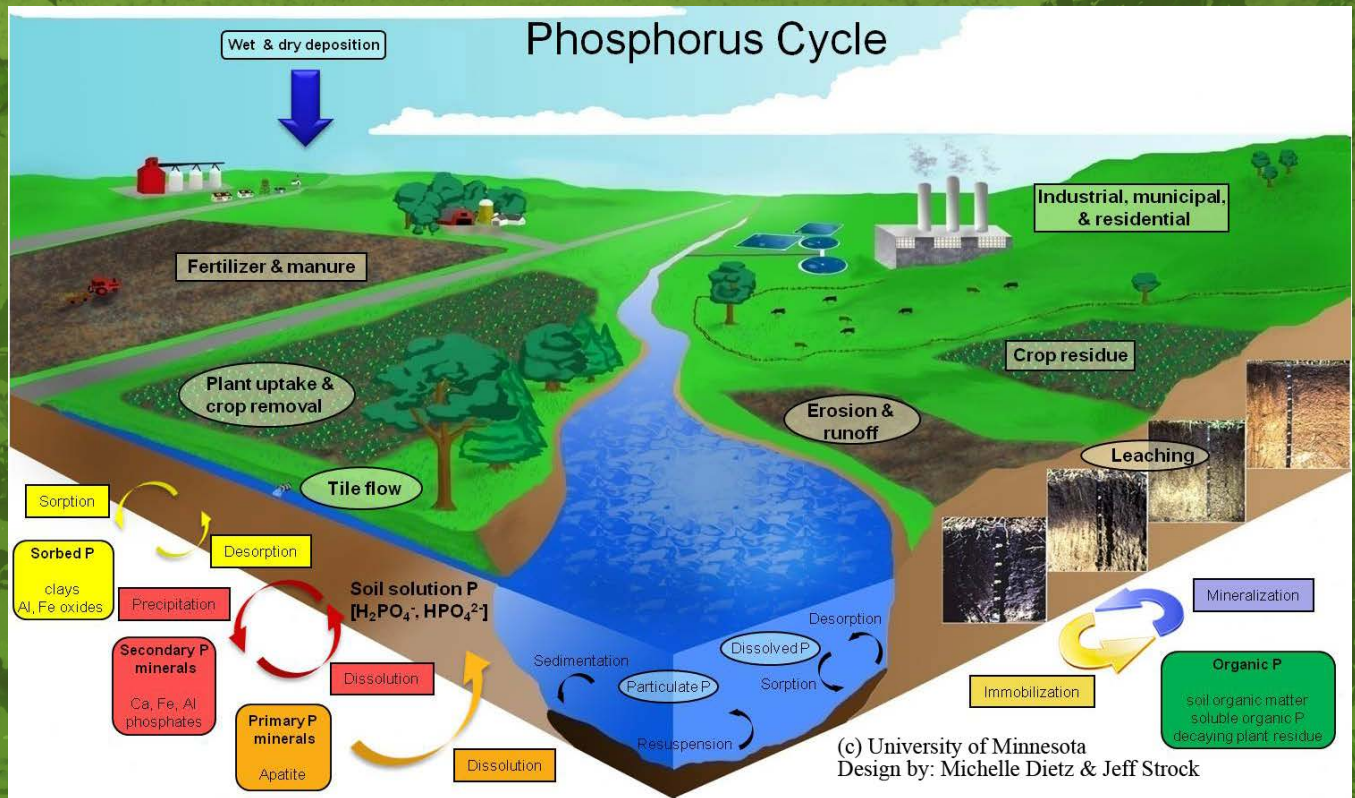
# Nitrate



- TCEQ nutrient screening level in streams: 1.95 mg/L
- Common source – lawn/crop fertilizers
- Health issues in finished drinking water
  - “Blue Baby Syndrome” (methemoglobinemia)
- Environmental - lakes
  - Algal bloom/bust → oxygen depletion → fish kills



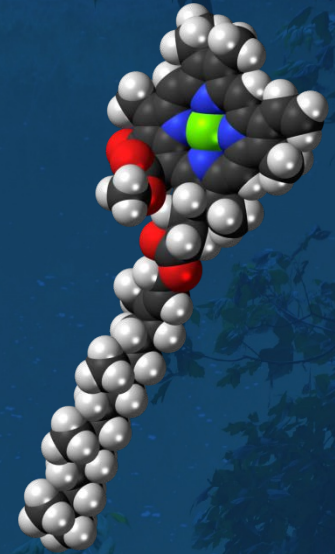
# Phosphorus



- TCEQ nutrient screening value in streams: 0.69 mg/L
- Common source – lawn/crop fertilizers
- Health issues of excessive phosphate
  - Rare, but can be linked to kidney failure and osteoporosis
  - Imbalances usually from prolonged medicine use, not water consumption
- Environmental – lakes (same as nitrates)
  - Algal bloom/bust → oxygen depletion → fish kills



# Chlorophyll-a



[https://en.wikipedia.org/wiki/Chlorophyll\\_a](https://en.wikipedia.org/wiki/Chlorophyll_a)





- TCEQ nutrient screening value in streams: 14.1  $\mu\text{g/L}$
- Photosynthetic molecule in most algae and plants that gives green color
- Used as surrogate for algal growth in water
- Another way to track potential algal blooms
  - Cause: high nutrient inputs to lakes/streams
  - Response: high chlorophyll-a production




# Fish Kills & Algal Blooms



## factors contributing to fish kills

- |   |   |   |  |
|---|---|---|--|
| <p><b>Low dissolved oxygen</b></p>  <p>due to oxygen consumption associated with algal blooms, chemical demands, or poor mixing.</p> | <p><b>Algal toxins</b></p>  <p>toxins produced by some species, under certain conditions</p> | <p><b>Contaminants</b></p>  <p>eg. hydrogen sulfide, carbon dioxide, ammonia, methane and other contaminants (e.g. metals)</p> | <p><b>Physical irritants</b></p>  <p>suspended sediment, algal cells and bacteria interfere with fish gills</p> |
|---|---|---|--|

## Nutrients







food for algae;  
sources can be natural or include rural and urban inputs

## of algal blooms

- Reduced flushing**
- 
- Nutrients more commonly accumulate in poorly flushed or mixed areas

### COMMON LOCATIONS OF BLOOMS & FISH KILLS

- In depositional areas (poorly flushed), e.g. lower catchments and near barriers
- In conjunction with salt wedge (due to low oxygen condition at bottom)
- In urbanised or rural catchments

Low dissolved oxygen	Algal toxins	Contaminants	Physical Irritants
			
due to oxygen consumption associated with algal blooms, chemical demands, or poor mixing.	toxins produced by some species, under certain conditions	eg. hydrogen sulfide, carbon dioxide, ammonia, methane and other contaminants (e.g. metals)	suspended sediment, algal cells and bacteria interfere with fish gills

- BARRIERS TO FRESH WATER AND NUTRIENT FLOW**
- Barriers to flow and nutrient
  - Barriers can reduce poor water quality
  - Low Oxygen conditions often occur in deposition areas



deeper or (poorly mixed). of reduced

Low Oxygen condition results in unavoidable conditions for breakdown of organic material by bacteria, which can reduce oxygen (due to respiration) and release bound contaminants.

### MICRO & MACRO ALGAE BLOOMS

- Algal growth requires nutrients and light. Higher temperatures can promote growth.
- Environmental effects from blooms include low oxygen (due to algae respiring at night), excess

(silly Canadiens)

### DECAY OF ORGANIC MATERIAL

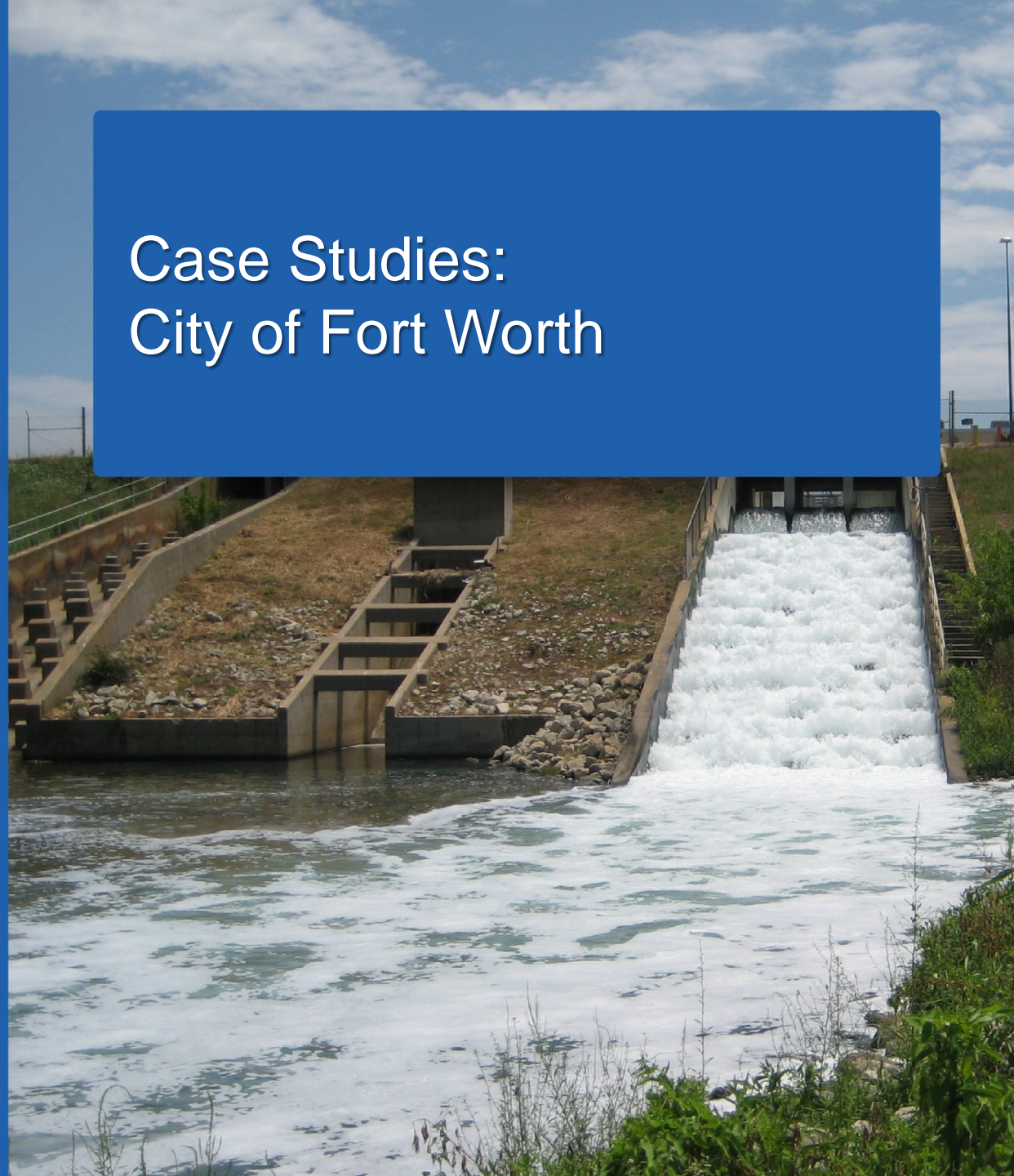
- Effects from decay of organic material include low oxygen (due to

● Social effects include odour and aesthetics

vegetation, eroded soils and natural, rural and urban sources)  
Micro & Macro Algal Blooms



# Case Studies: City of Fort Worth



# Tampons: A Cost - Effective Method to Detect Sanitary Sewer Infiltration in the MS4

Casey Nettles

Code Compliance | Environmental



# Background

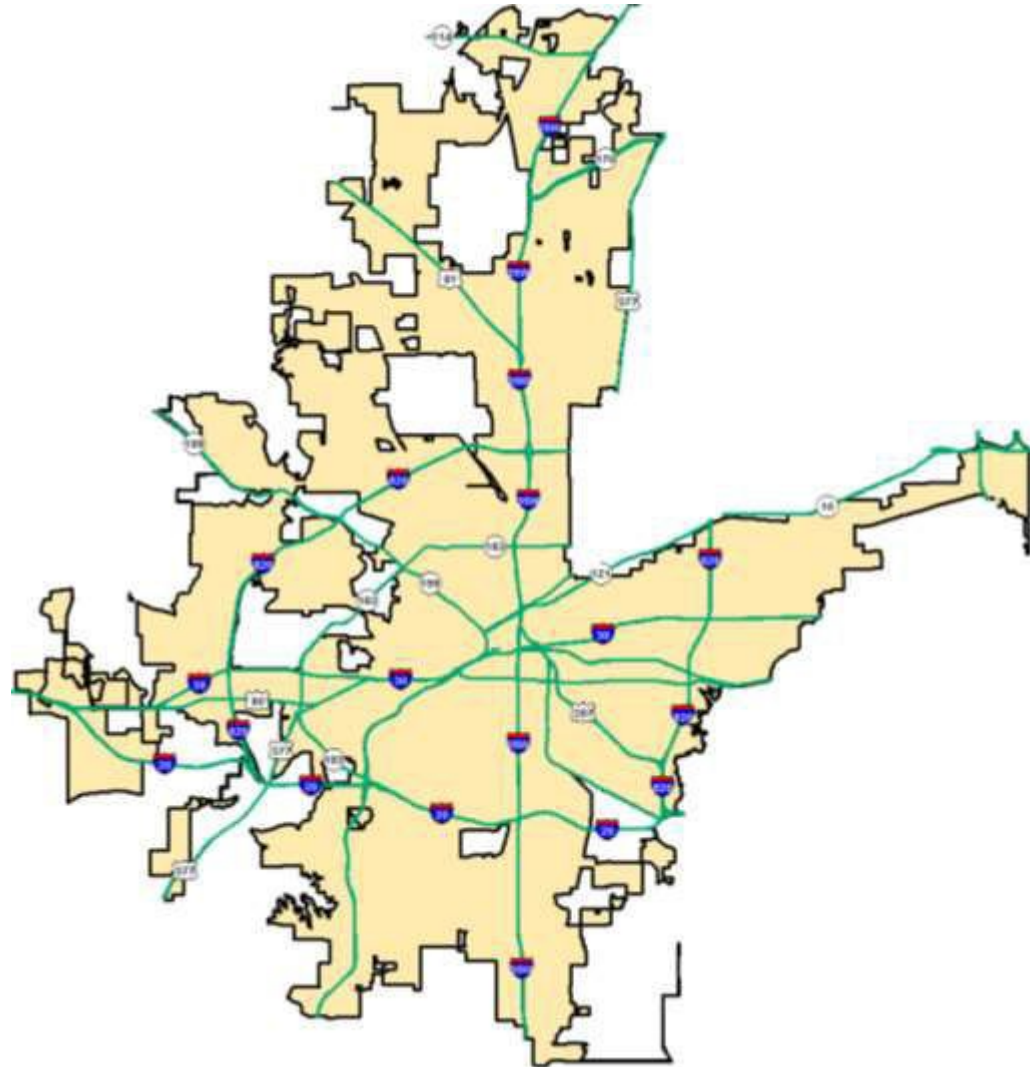
- City of Fort Worth
  - 16<sup>th</sup> Largest City
  - 2015 population—833,315
  - 353mi<sup>2</sup>
  - Phase I city
    - NPDES 1996-2005
    - TPDES 2006-present





# Background

- 1,308 miles of MS4 lines
  - 1905
- 3,336 miles of Water lines
  - 1911
- 3,266 miles of Sanitary Sewer lines
  - 1906



# Background

- Impaired Waterbodies (bacteria)
  - Sycamore Creek (0806E)
  - Village Creek (0828A)
  - Marine Creek (0806D)
- High bacteria loads at outfalls and within stream segments
- Need to determine source of bacteria?
  - Human, wildlife, or domestic

# Background

- CCTV the MS4 and find illicit connections
  - Sure, where's the \$\$\$ going to come from?
- Smoke test the MS4 and wait
  - We all know smoke testing is quick...
- Bacteria source tracking (DNA fingerprinting)
  - Again, \$\$\$



# Background

- Test for optical brighteners
  - Optical brighteners are found in laundry detergent, used to "make your whites whiter and your brights brighter"
  - Also present in a number of hand soaps
  - Not naturally occurring
  - When optical brighteners are present they will fluoresce under UV light

# Problem

- How do we test?
  - Fluorometer
    - Initial cost \$2000
    - Can only analyze grab samples (no time lapse)
  - Optical method: tampons!
    - Cost less than \$0.30/sample
    - Scientific “black light” lamp = \$600-\$700
    - Grab or composite sample
    - Involve citizen science groups (or school groups)

# Solution

- “Unbleached cotton/rayon sample media utilized for optical brightener collection and analysis”
- If optical brighteners are present, they will glom onto the tampon and cause it to glow under UV light



# Case Study 1

- Study area: Vicinity of TCU/FW Zoo
- Series of outfalls with ambiguous sampling results
  - Ammonia-nitrogen was elevated and E. coli was less than 2,400MPN/100mL
    - Not necessarily an SSO, could be wildlife
  - Area has infrastructure from the 1920s



# Case Study 1



# Case Study 1

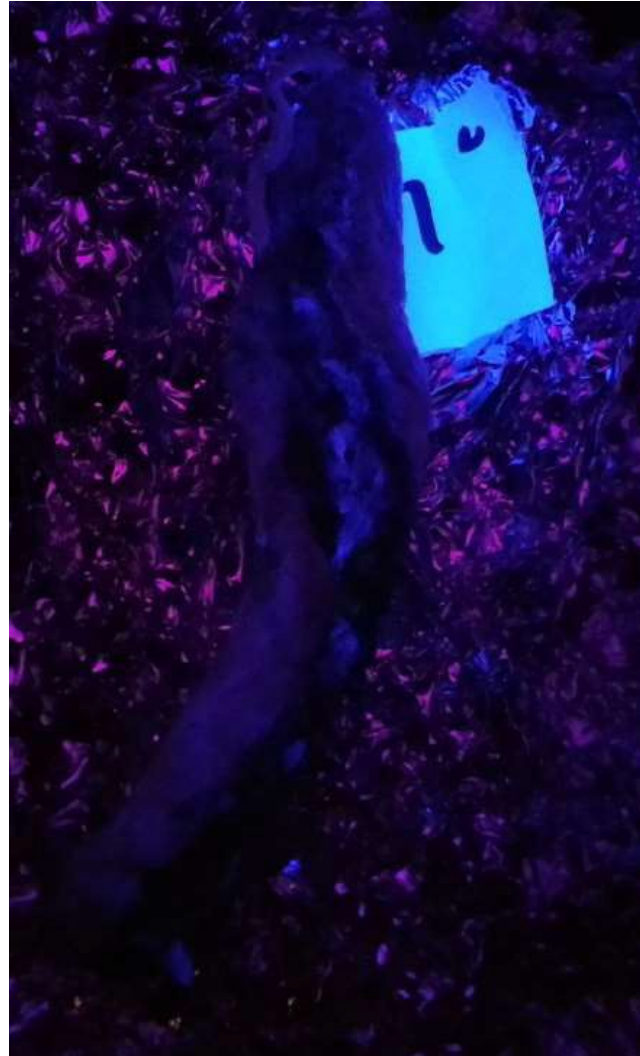




# Case Study 1



# Case Study 1



# Case Study 1

- Break in sanitary line just past lateral connection
- Water Department repaired break
- Outfalls are optical brightener free



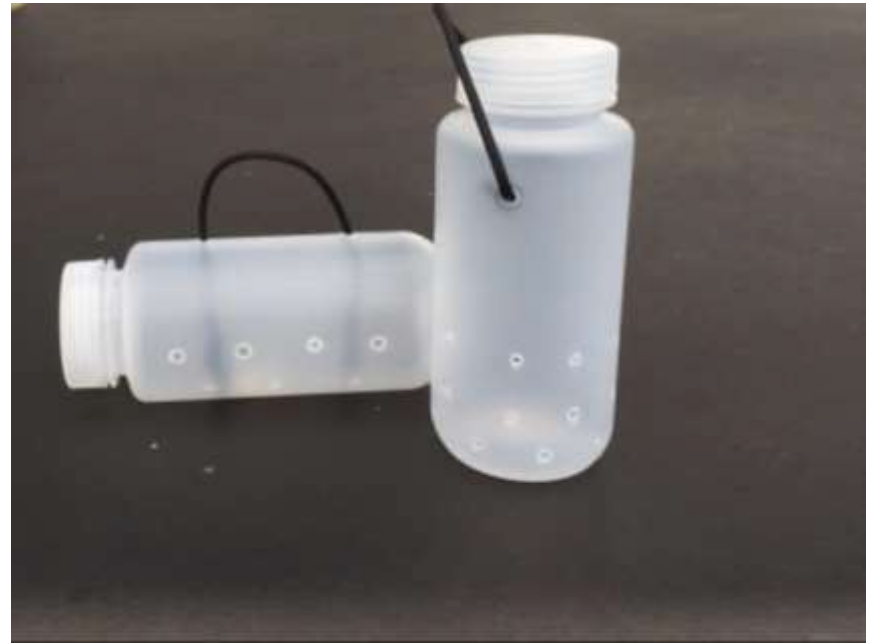


# Case Study 2

- Source tracking for elevated river bacteria levels
- Elevated results not associated with rain events
- Sampled at outfalls discharging into the river



# Case Study 2



# Case Study 2





# Case Study 2

- One outfall had consistent positive optical brightener results
- Tracing back the source



# Summary

- Tampons provide an inexpensive test method for sanitary sewer infiltration in storm drain systems
- Can be used for a grab sample or composite
- Detect optical brighteners at low (0.1ppm) concentrations

# Questions?



## Casey Nettles

Environmental Supervisor

Water Department-Pretreatment Services

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## City of Fort Worth

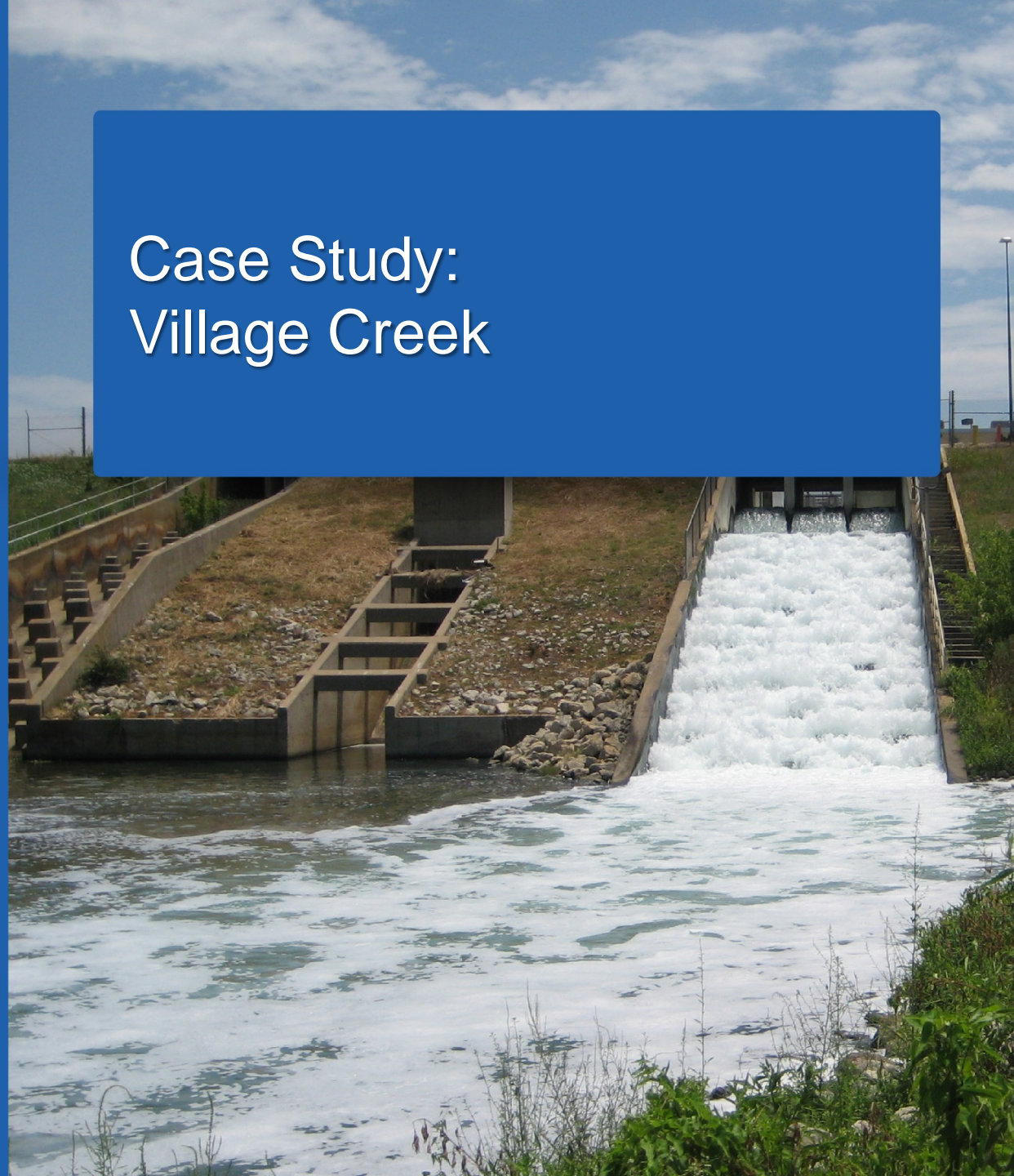
Code Compliance | Environmental

1000 Throckmorton St

Fort Worth, Texas 76102



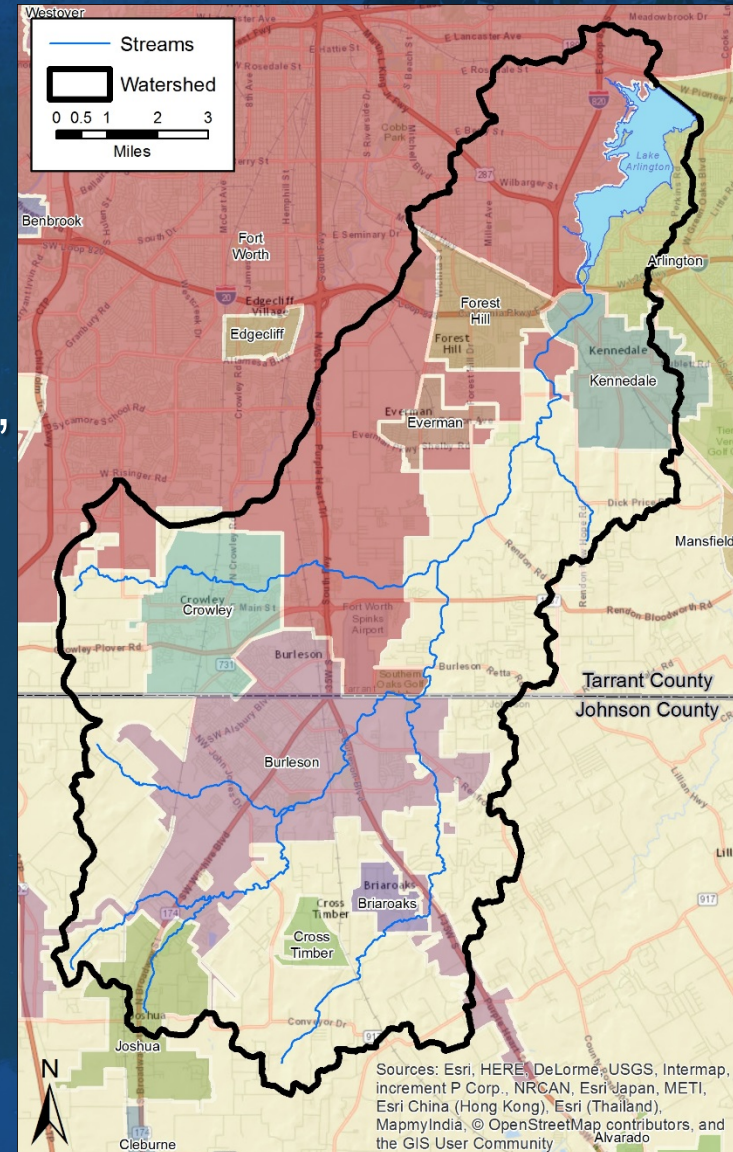
# Case Study: Village Creek





# The VCLA Watershed

- Lake Arlington
  - Drinking water
  - Recreation
  - Rapidly developing
  - Multiple municipalities, local authorities
  - Listed for nutrient concerns (nitrates, chlorophyll-a)
- Village Creek
  - 303(d) list for *E. coli* impairment
  - Additional entities involved





# Why Tampons?

- Unincorporated areas with large populations (CDPs) present in watershed
  - Significant perceived OSSF concerns
- Records of significant SSO events near lake
  - Direct input of raw sewage and/or contaminated stormwater to lake



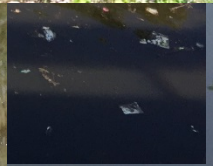
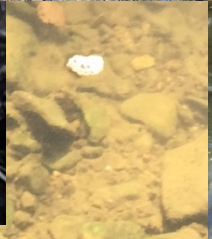
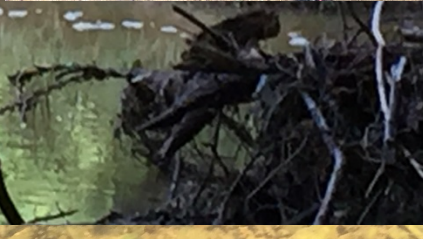






# Several... "situations" along the way

VC 07  
7/1/2016  
1 day  
deploy









# Take-home message

- “Take-office” message just sounds like a weird way to close a presentation (brought to you by Deep Thoughts)
- The ol’ “CFG” Paradigm – You get to pick 2
  - CHEAP ✓ FAST ✓ GOOD ??
- Have to define “good” based on the goal of the study
  - Broad-scale exploratory study, large area ✓
  - Pinpointing OSSFs issues in big watershed X
  - Chasing down sewage leaks into stormwater infrastructure ✓
  - Tracking malfunctioning OSSFs in a smaller creek (to avoid entering multiple properties) ?



# Questions?

<http://www.trinityra.org/lakearlingtonvillagecreek>

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# Roundtable Discussion



Thank you!

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