E. Coli bacteria in our local streams: A case of the Village Creek in Everman, Texas

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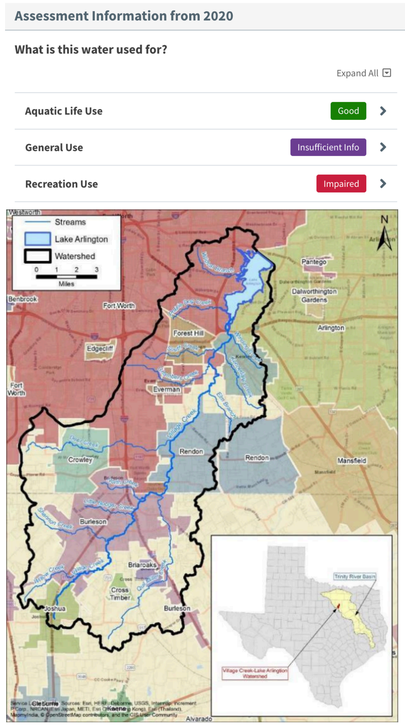
Introduction

The United States Environmental Protection Agency (US EPA) classifies nearly 28% of assessed rivers and streams in Texas as impaired due to pathogenic bacteria in the water. One such stream is the Village Creek, a tributary of the Trinity River in north-central Texas. The EPA website "How's My Waterway" lists Village Creek as impaired with *Escherichia coli* (*E. coli*), with no plan in place to reduce *E. coli* counts. Therefore, this study in the Water and Society Lab at TCU aims to monitor *E. coli* concentration in the Village Creek. *E. coli* levels over 126 CFU per 100 mL water sample indicates unsafe levels per the Texas Commission on Environmental Quality (TCEQ) and the US EPA. *E. coli* consumption can cause diarrhea, urinary tract infections, respiratory illness, and pneumonia, among other illnesses. With more research into the causes of *E. coli* impairment in our local waterbodies, we can help to determine how to mitigate them. In 2019, the Village Creek-Lake Arlington Watershed Protection Partnership created a watershed protection for Village Creek, which maintained that reducing *E. Coli* can also help to reduce other pollutants.



Objective

To determine if levels of *E. coli* in Village Creek are safe or unsafe per TCEQ standards. We will also investigate any relationship between *E. coli* and streamflow within the watershed.

Methodology

In this ongoing study, we collect water quality samples weekly from USGS site 08048970, Village Ck at Everman, TX. With these samples, we determine the presence or absence and total *E. coli* count as CFU (colony forming units) using the US EPA-approved Colilert Test.

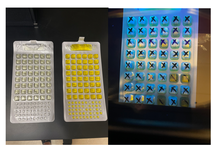
Take two 100 mL water samples each week with minimal sediment from the middle of the river.

Back at the lab, add the reagent that will react with the sample. Earlier in the semester we diluted the samples, but ceased once the E. coli levels dropped.

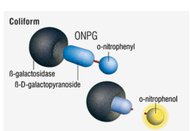
Move the sample with reagent into Colilert Quanti-Tray, used when quantifying coliform. Seal with Quanti-Tray Sealer.

Incubate the samples for 24 hours at 35 °C to determine the presence or absence of both coliform and *E. Coli.*

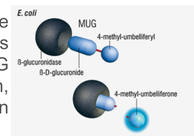
Determine presence of total coliform and *E. coli* by determining if the sample is more yellow than the comparator and if it fluoresces.



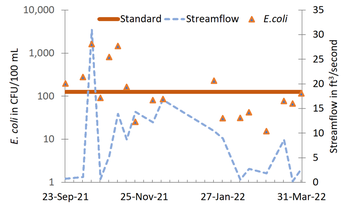
Use the MPN chart to determine how many *E. coli* CFU are in the sample.



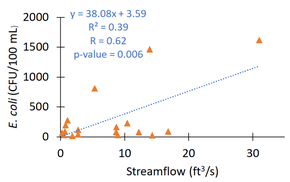
The Colilert Test uses Defined Substrate Technology (DST) to detect total coliforms and *E. coli*. The nutrient indicators ONPG and MUG are the major sources of carbon, which coliform and *E. coli* enzymes can metabolize during incubation.



Result



Measure *E. coli* and Streamflow in the study site



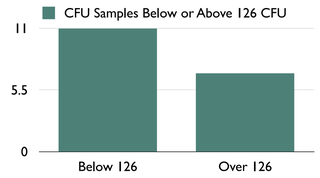
Linear regression between E. coli and streamflow

3. Relationship and regression between *E. coli* (dependent variable) and streamflow

R	0.62
R^2	0.39
Adjusted R^2	0.35
p-value	0.006

Descriptive Statistics of *E. coli* samples

Count	18.0
Mean	301.4
Geometric mean	119.5
Median	89.0
Minimum	15.5
Maximum	1,620.0
Range	1,604.5
Sample Variance	237,158.9
Standard Deviation	487.0
Standard Error	114.8
Kurtosis	3.8
Skewness	2.2



Conclusion

From our research so far, we have counted 11 *E. Coli* counts under the unsafe threshold and 7 over the threshold. Since there are still counts over the unsafe threshold, it is important to continue the research. We found that streamflow and *E. coli* have a mild correlation, while there was no correlation between temperature and *E. coli.* Because we have no concrete answers yet, we must continue our research to ensure consideration of all variables that may affect *E. coli* levels. Therefore, the next important step in this study is to build the statistical relationship of *E. coli* with different hydro-climatological variables, including streamflow, rainfall, ambient temperature, water temperature, pH, conductivity, and turbidity. The findings of this study, if sound, could help make water quality and water resources management decisions in the north-central Texas region.

I would like to thank Grace Turner for beginning this project and teaching me how to continue it. I would also like to thank the environmental science department for being a great resource during this project. I would also like Caroline Stucky and Isabella Moreno for their work as student researchers during this project.

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