# Investigating Potential Pollutant Sources Causing Lack of Biodiversity in Lytle Creek and Indian Run

Audrey McGowin, Ph.D. and Amira Alsenbel, M.S., Department of Chemistry
Wright State University, Dayton, OH 45435 (audrey.mcgowin@wright.edu)

Harry McVey, City of Wilmington Wastewater Treatment Plant Superintendent
Lori Williams, Former City of Wilmington Parks and Recreation Director
Taylor Stuckert, AICP, Clinton County Regional Planning Commission Executive Director

## EXECUTIVE SUMMARY

This executive summary describes the results of research performed with funds from the Sture Fredrik Anliot Grant Fund granted in March 2016 and the Wright State University College of Science and Mathematics. The title of the grant was "Lytle Creek and Indian Run Sediment and Water Pollution Assessment" and its primary aim was to identify and measure pollutants that could be causing a lack of biodiversity in Lytle Creek in Wilmington, OH. The full report will be available for free download on or before October 10, 2017 at https://works.bepress.com/audrey_mcgowin/.

Lytle Creek is a tributary of the Little Miami River that is 10 miles long and runs through the City of Wilmington, OH. It has a long history of use as a national research creek for the development of municipal wastewater treatment processes in the 1940s through the 1960s. Ohio EPA reports have documented a lack of invertebrates in Lytle Creek in Wilmington that have been attributed to storm water runoff from the Air Park containing deicing chemicals and chemicals from various spills over many decades. Based on the historical evidence, the lack of invertebrates and reduced biodiversity in Lytle Creek is likely the result of three possible causes:

1. Repeated insult from storm water runoff or discharges containing substances causing fluctuations in water quality that degrade ecological conditions and prevent invertebrates from reestablishing healthy populations.
2. The toxicity of chemicals in storm water runoff or discharges repeatedly poisoning invertebrates.
3. Persistent pollutants embedded in the sediment are toxic to invertebrates.

This project was, in part, a way to verify that improvements to airport runoff treatment were effective in reducing damage to Lytle Creek and Indian Run, especially during winter months. Part of the project's mission was overcome by events (OBE) in May and June of 2016 when repeated fish kills were reported in Lytle Creek at Sugar Grove Cemetery and at Xidas Park downtown. The downtown tributary to Lytle Creek flows above ground through downtown Wilmington between Buckley Bros Inc. and Master Feed Mill Inc. then underground under the Clinton County Courthouse and emerges behind Xidas Park. This tributary flows along the bike path to join Lytle Creek at Sugar Grove Cemetery. It receives the flow from downtown storm drains. Children are often seen playing along this tributary and in Lytle Creek. Previous OEPA studies did not include measurements from the downtown tributary that was found in this study

to be as contaminated as Lytle Creek behind Sugar Grove Cemetery and presently the source of toxic substances that inhibit biodiversity in Lytle Creek.

*May-June 2016 Fish Kills*

The first report of dead fish in the tributary of Lytle Creek was made by as a citizen phone report on May 16, 2016 to Ohio EPA. Harry McVey, WWTP supervisor, was responsible for investigating the source with the assistance of OEPA and ODNR. The source was determined to be an illicit discharge to storm drains by American Façade Restoration, LLC, which was subcontracted by Perfection Group to power wash the Clinton County Courthouse during the renovation. They were using a mix of tri-sodium phosphate (TSP) detergent and bleach and were required to retain the runoff for proper disposal. They also used SureKleen® Vana Trol® which is very strong acid. Bleach and strong acids are extremely toxic and mixing them can produce deadly chlorine gas. TSP contributes to algae growth in steams. None of these substances should be released into the environment untreated. They had been notified of the proper procedures before beginning the process. After several fish kill incidents, Perfection Group, Inc. received a Field Notice of Violation (FNOV) from OEPA Division of Environmental Response, Investigation and Enforcement on June 21, 2016. Observations along the creek bank of rotting organic matter and excessive algae growth along with measurements of dissolved oxygen, pH and ammonia indicated that there was also rotting organic matter present.

During the investigation of the fish kill, it was also determined that two downtown businesses did not have proper storm water discharge permits. This was rectified by August 16, 2016 when new storm water permits were issued.

Figure 1. Photos taken at Xidas Park during June 2016 fish kill.

*Metals Analysis Results*

Measuring heavy metals in sediments is a good way to begin looking for potential pollution sources. Metals are elements and do not biodegrade over time so they can serve as a semi-permanent record of water pollution. For example, lead (Pb) from leaded gasoline sold in the mid-twentieth century is much higher in sediments near old roadways. Crumbling old highway paint contains Pb and chromium (Cr) and industrial spills leave traces of metals behind.

In June 2016, sediment samples were taken at five sites along Lytle Creek, two sites in Indian Run, and at Xidas Park and tested for heavy metals using EPA Method 200.7. Another site, Hebble Creek sediment from Fairborn, was added for comparison. Figure 2 shows the average total metals concentrations that were measured at each of the sites. Site descriptions are in the full report. Xidas is Xidas Park and LCSGC is Lytle Creek at Sugar Grove Cemetery. Sites are listed from upstream to downstream for each creek.

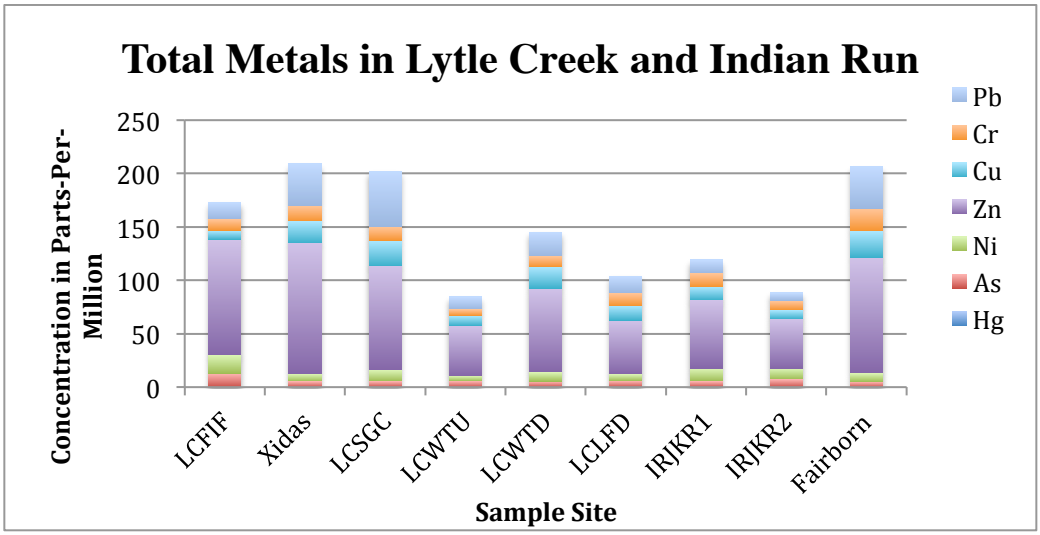


Figure 2. Total metals (parts-per-million) in sediments from Lytle Creek, the downtown tributary (Xidas), Indian Run and Hebble Creek in downtown Fairborn.

Total heavy metal analysis shows that the Wilmington sediments are comparable to Fairborn sediments in total heavy metal load with Xidas Park having the highest in Wilmington followed by Lytle Creek at Sugar Grove Cemetery. While some of this could be historical pollution from leaded gasoline, etc., it indicates repeated events where storm water is depositing hazardous substances into local creek sediments and that much of this originates from the downtown storm drains.

Two problematic heavy metals, mercury (Hg) and Pb, are reasons for concern when children are exposed by playing in Lytle Creek and the downtown tributary. Elevated levels of Hg and Pb were measured in sediment samples taken from behind Xidas Park and behind Sugar Grove Cemetery. One of the samples taken at Sugar Grove Cemetery (0.292 mg/kg dry weight) exceeded the Threshold Effect Concentration (TEC for Hg is 0.18 mg/kg dry weight) although it was below the Probable Effect Concentration (PEC) for mercury in sediments of 1.06 mg/kg dry

weight. Above the TEC, sensitive species, like invertebrates could be harmed but the PEC is the concentration above which harmful effects are likely to be observed. Mercury concentrations at the other sites were 5-10 times lower. Figure 3 shows Hg results. The elevated Hg in the Xidas Park sediment could not have originated from the Hg spill reported at the airpark in 2006, but likely originated in storm water runoff. Whether the elevated Hg at Sugar Grove Cemetery originated from the 2006 spill or from storm water runoff from downtown could be further investigated using isotope ratio analysis but is it likely from downtown runoff.

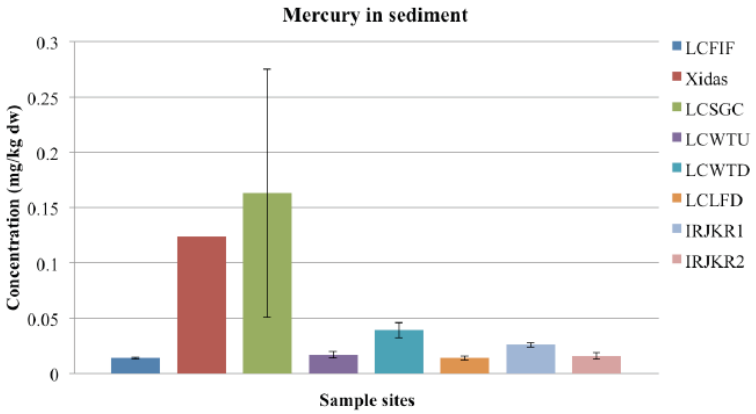


Figure 3. Mercury (Hg) in sediment. Threshold Effect Concentration (TEC) for sensitive species = 0.18 mg/kg dry weight. Probable Effect Concentration (PEC) for mercury in sediments of 1.06 mg/kg dry weight.

The concentrations of lead (Pb) measured in Sugar Grove Cemetery, Xidas Park, and Fairborn sediments fell in between the TEC (35.8 mg/kg dry weight) and the PEC (128 mg/kg dry weight) and ranged from 24.3 to 56.5 mg/kg dry weight. As can be seen in Figure 4, Pb measured at the other sites ranged from 5.1 to 24.4 mg/kg dry weight. Much of the Pb contamination likely resulted from old spills of leaded gasoline.

It is important to note that the TEC and PEC values do not take into account combined effects of heavy metal toxicity, which are poorly understood.

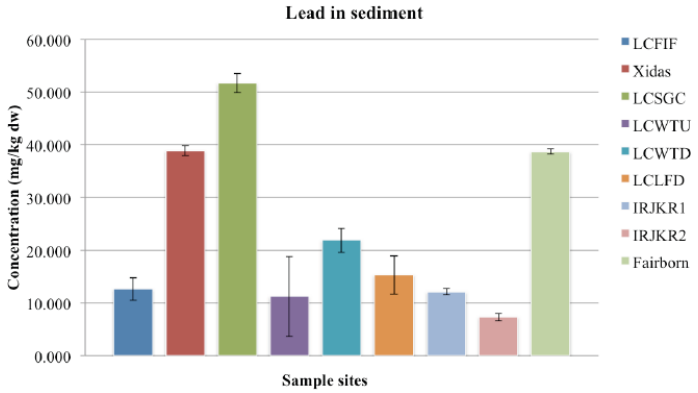


Figure 4. Lead (Pb) in sediments, TEC is 35.8 mg/kg dry weight and PEC is 128 mg/kg dry weight.

*Water Quality Analysis Results*

Five sites were selected for periodic water quality evaluation. Measurement of dissolved oxygen (DO), temperature, conductivity, ammonia, and pH were done on site using a calibrated YSI Multimeter in addition to an overall visual and odor assessment. Samples were taken back to the laboratory for analysis of seven anions (EPA Method 300.1) that included nutrients found in wastes and fertilizers such as nitrate and phosphate. All of the measurements taken were within normal parameters except for some concerning measurements taken from the downtown tributary during the fish kill episode. Table 1 shows water quality measurements taken during the June fish kill June 21, 2016. Bleach causes specific conductivity and pH to increase. Reduced Dissolved $O_2$ at CVS manhole indicates that water quality is already compromised before it passed under the courthouse. High ammonia readings indicate rotting organic matter or sewage.

Table 1. Water Quality Measurements Taken During June 21, fish kill.

| | pH | Dissolved $O_2$ | Specific Conductivity ($\mu$Si/cm) | Ammonia-N (mg/L) |
|---|---|---|---|---|
| Manhole at CVS | 7.6 | 70% | 422 | |
| Xidas Park | 7.4 | 23% | 1031 | 9.15 |
| Tributary behind hospital | 7.70 | 129% | 1549 | 1.79 |

*Escherichia coli*

Enumeration of *Escherichia coli (E. coli)*, a pathogen found in water contaminated by feces, was performed on samples taken at the same five water sites. *E. coli* sources include untreated sewage, leaking septic systems, wild animals, and residents who do not pick up after their pets. The samples were incubated using 3M Petri Plates, which contains a dye that turns blue when metabolized by *E. coli* bacteria. Figure 5 shows the results of the *E. coli* analysis. The July 13 sampling was during a significant rain event showing how feces can be washed from streets and lawns into local waterways. The *E. coli* results were higher than those in previous OEPA reports indicating that this type of pollution has increased. The Feb. 17 elevated *E. coli* count at Xidas Park (LCTXP) was determined to be due to a sewage issue that has since been repaired.

Most of the sites are higher than the 7-Day and 30-Day Ohio EPA limits for recreational waters. Although not all strains of *E. coli* are harmful, exposure to such high levels would be unhealthy especially for children and people with compromised immune systems.

*Conclusions*

The results of this study show that the lack of invertebrates and reduced biodiversity in Lytle Creek can be attributed to all three of the following:

1. Repeated insult from storm water runoff or discharges containing substances causing fluctuations in water quality that degrade ecological conditions and prevent invertebrates from reestablishing healthy populations.

2. The toxicity of chemicals in storm water runoff or discharges repeatedly poisoning invertebrates.
3. Persistent pollutants embedded in the sediment are toxic to invertebrates.

The major contributor to poor water quality in Lytle Creek was storm water runoff from downtown Wilmington. The Air Park was not a major contributor to reduced water quality during the study period. However, it was a warm winter with little use of deicers, etc.

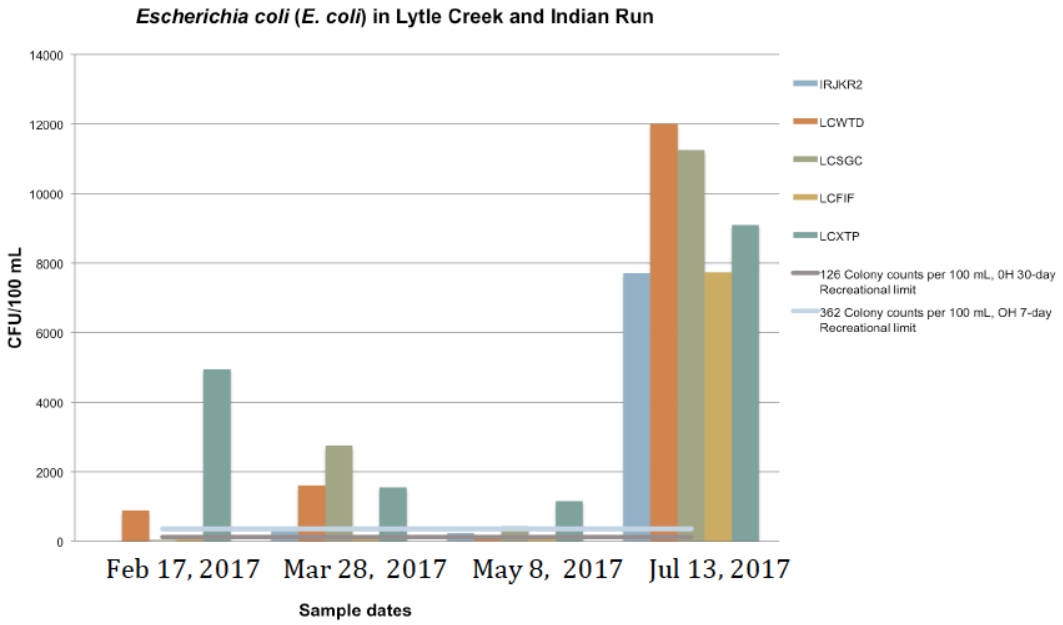


Figure 5. *E. coli* results from sample sites.

## Recommendations for Action

In recent years, municipal wastewater departments have been tasked by the state with enforcement of storm water runoff management and enforcement (MS4 program) with little to no resources to achieve this enormous and critical task. A lack of awareness or concern by some businesses and citizens about what is going down the storm drains in downtown Wilmington creates a hazardous situation for children who play in the downtown tributary. Based on the results obtained in this study, we are making the following recommendations.

1. Make sure all downtown business have proper EPA Storm Water Management Permits and that there is oversight and enforcement of permits and regulations.
2. Engage area businesses and the public in an education campaign about the dangers of improperly dumping hazardous substances into storm drains.
3. Provide citizens easy access to proper methods for household waste disposal.
4. Educate families about the dangers of children playing in storm water runoff.
5. Continue to monitor water quality in Lytle Creek, the downtown tributary, and Indian Run.
6. Consider further investigations into sediment contamination in Lytle Creek and the downtown tributary.