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Summer Research Report

The University of the South

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Investigating Sewanee's Wastewater Treatment

This summer I had the opportunity to work as part of a team in Sewanee's Chemistry Department with the mentorship of Dr. Emily White, Sewanee's environmental chemist. The focus of my research was to study Sewanee's wastewater treatment process as part of a larger project investigating its effectiveness in removing contaminants from the wastewater. Sewanee's Wastewater Treatment Plant consists of three lagoons in which the wastewater is collected. After making its way through the lagoons, the water goes through a chlorination process and is sprayed onto a series of sprayfields in the forest. Little is known about the ability of wastewater treatment plants to remove chemicals found in pharmaceuticals and personal care products (PPCPs). Because these chemicals, which find their way into the wastewater, may not be removed, this is an important research topic. PPCPs are considered "emerging contaminants" due to the growing concern of their impact on the environment.

For the first few weeks of the internship, I learned basic lab skills such as pipetting, properly using the lab equipment, and washing the glassware to avoid contamination. I spent most of the summer learning all the analytical methods and procedures required to test samples for nutrients such as nitrate, nitrite, ammonium, total nitrogen, and phosphorus compounds. For each method I had to make different standards and use certain instruments in order to produce a calibration curve that showed good linearity, before I could test actual samples. I found myself spending a lot of time testing out and utilizing the expensive equipment such as the UV-visible

spectrophotometer and the autoclave on the standards that I made. Alongside learning those methods, I learned to conduct other tests and calibrate other instruments to determine sample pH, conductivity, turbidity, dissolved oxygen, and *E. coli* and coliform counts.

Using the methods learned throughout the summer, we began testing samples from various bodies of water located around campus. For a few weeks we monitored Harrison Spring using the methods and tests learned. This was significant since there are people in the community who drink from this source on daily basis, and previous research has found elevated levels of nitrate, phosphate, and bacteria in the water. There were three locations that we focused on for Harrison Spring: the source of the water located in a cave, the drinking water in the pipe, and a nearby stream. After conducting various tests for weeks, we did not find significant amounts of nitrate or nitrite. However, there were a few days where we did find significant levels of phosphorus and total nitrogen. We also noticed that there were high counts of *E. coli* after it rained. We also tested water from Lake Torian on Sewanee's Golf Course to get more experience on how the group would work as a team to test as many samples as we could before the end of the internship. The samples tested from the golf course pond contained low levels of phosphorus.

As soon as we got used to conducting the tests and working together as an efficient team, the end of the internship was approaching. I spent part of the remaining time going back to check standards for one method, because we suspected that their concentration was too low. It was during this time of backtracking my steps that I learned how to standardize solutions to get their exact concentrations. However, I did get to spend my final week gathering and testing samples from Sewanee's Wastewater Treatment Plant. Samples were collected from the three lagoons, the chlorination tank, and three nearby streams that egressed the sprayfields. Samples were tested for phosphorus, nitrogen, and all the other methods learned. We were able to detect nitrogen

and phosphorus in our samples. In order to confirm our results, we need to conduct more tests throughout the year to more thoroughly monitor the wastewater treatment process.

Before I knew it, my summer experience as an intern had ended and I was heading home. On the way back I thought about all the great experiences that this internship had given me, as well as the not-so-exciting moments. By working as part of a team, I was able to make a difference. The work that I put into figuring out all the methods and testing all the equipment will pave the way for future researchers who will use our data to continue monitoring Sewanee's Wastewater Treatment Plant. I was also able to positively give back to our community by determining whether the water from Harrison Spring was safe to consume.

I was given the opportunity as a science-oriented student to develop better lab skills and have a chance to have an experienced professor, such as Dr. White, give me advice and lead me in the right direction. Not only did I learn to use various instruments while gaining knowledge of how to analyze different compounds, I learned what being a researcher is all about. I realized that the frustrating moments of trying to figure out what you did wrong to improve your tests or the even less exciting moments of waiting were all part being a researcher. There were plenty of times when experiments did not go as well as I had planned, but it was during those times that I learned the most. This internship had an overall positive impact on my future career goals. It allowed me to see that I still want to continue my path of becoming a dermatology researcher.