



# The Effects of the South Cushman Shooting Range on the Tanana River, Fairbanks, AK

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## Abstract

As members of the UAF Rifle Team and Natural Resources and Environment majors, we have a shared passion for shooting sports along with the environment. This research project takes both these passions and creates an opportunity for us to share our experiences while also adding to a sparse dataset. The objective of this project is to take the data that we collect and compile it in such a way to encourage further research and the betterment of our waterways. The South Cushman Shooting Range is an area that has minimal precautions in place for pollution, so we hypothesize that the data we collect will show that this facility has a profound impact on the overall quality of the Tanana River. Using Hydrology GLOBE protocols for pH and temperature, along with the measurement of Total Dissolved Solids (TDS), we hope to show quantitative data to support our hypothesis. If our hypothesis is supported, this would constitute a change in the way this facility and others operate, requiring stronger pollution prevention systems to be put in place.

## Introduction

Our GLOBE project research is regarding the amount of pollution being emitted from the South Cushman Shooting Range and how it is affecting the water quality of the Tanana River. As with most facilities, there are not a lot of preventative measures to help protect the environment from foreign materials entering the waterway. Peter John (2003) states: "Shooting Complexes present a potential threat to waterways" and that there needs to be a better monitoring process for the pollutants. We chose this topic to bring awareness to pollution and identify if this particular shooting range is causing a disturbance to the river. "We must recognize that the American public desire to conduct recreational shooting and that these activities do disperse lead into the environment" (Craig & Associates, 1999). "No studies have been conducted at a broad geographic scale to determine the potential environmental lead contamination from discharged shot from many shooting ranges," (Darling & Thomas, 2003) and there is not a lot of scientific information that can be equated with this site, so this project will bring an insight into this issue that has not been seen before. We hope to use the information that we gain from our research to help implement better practices at shooting ranges across the area. This will eliminate any concerns about the contamination of the waterway and allow the community to continue using these water sources without any apprehension.

## Methodology

The objective of this research is to understand if the Tanana River, which flows near the South Cushman Shooting Range in Fairbanks, Alaska, located at (64°47'37.4"N, 147°41'48.5"W), is being impacted by the water runoff from this particular location. In order to understand if there has been any variation, this research work has identified sampling locations before as well as after the region where the water mainly passes through.

Site 1 is situated on the right-hand side of the research map, right along the river. The region includes tall grass, sandy soil, as well as some evergreen trees. Site 2 is situated along the left-hand side of the research map. The region includes some mix of evergreen and deciduous trees, sandy soil, as well as riprap along the bank.

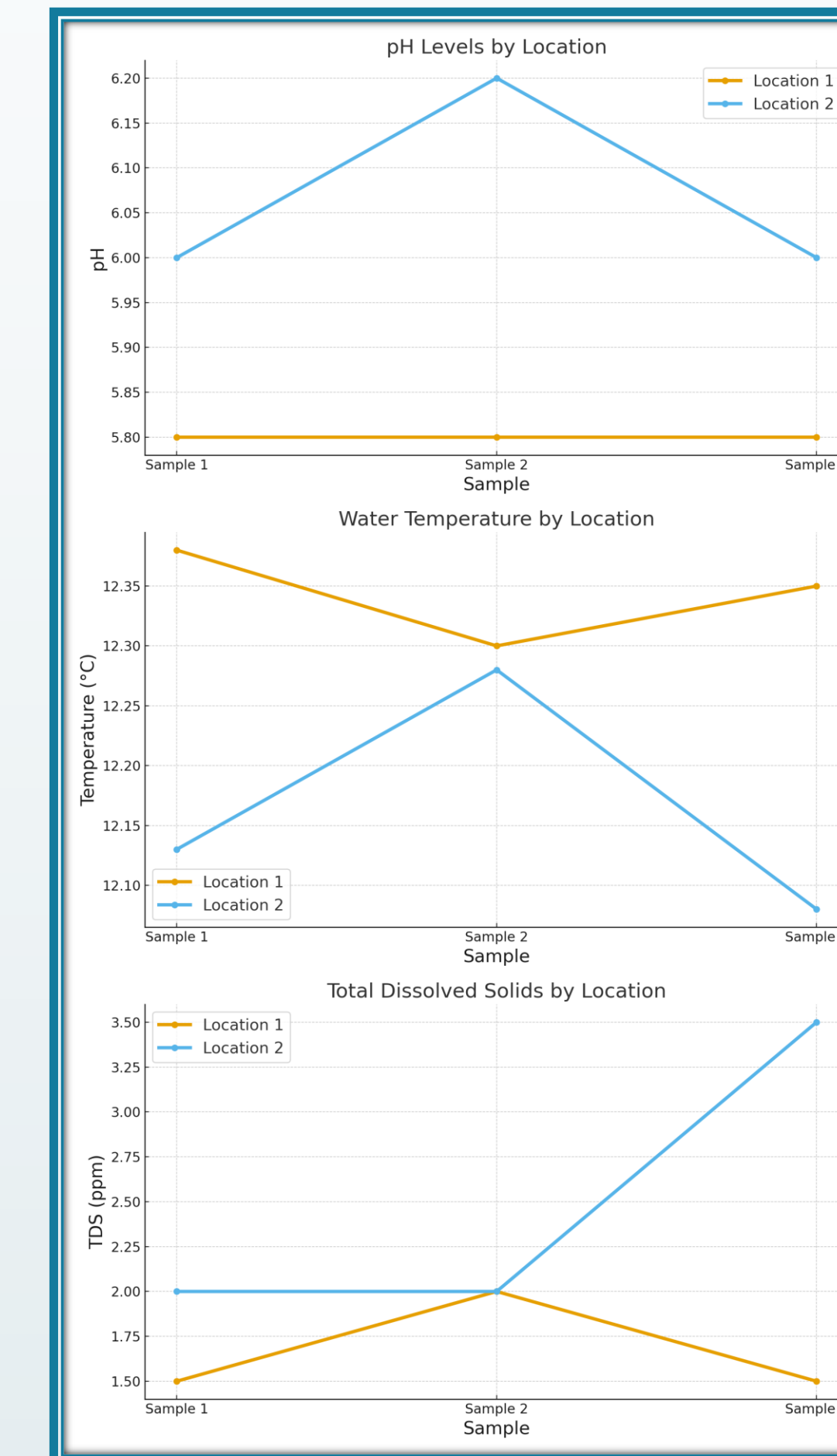
In addition, each measurement was made following the GLOBE Hydrology Protocol, which entailed the measurement of water temperature, pH, as well as TDS. The process of obtaining water was performed through the use of a rope-suspended bucket, which was lowered from the bank into the water to obtain mid-stream water, as opposed to digging in the soil at either of these two sites, where the bank has proven to be prone to erosion. In the bucket, three independent samples were collected, where temperature, pH, as well as TDS measurements were obtained.



Shotgun shells and debris deposited downstream of the site

## Results

Water quality data obtained both upstream and downstream of South Cushman Shooting Range showed distinct trends for both pH, TDS, and temperature that identify differences at both locations (Table 1).



**pH:** The results at Location 1 showed uniform acidity, with each sample having a pH level of 5.8. The samples at Location 2, on the other hand, showed a slightly increasing trend, from 6.0 to 6.2. While both locations remained in an acid environment, the downstream location has increased in pH value, which indicates a visible shift in water chemical composition after passing through the shooting range area.

**Temperature:** The water temperature is relatively constant between the two locations. Location 1 varied between 12.30-12.38 °C compared to 12.08-12.28 °C at Location 2. These values are within a standard range, and more research would be needed to determine whether the differences are significant and why they are occurring.

**Total Dissolved Solids (TDS):** The concentration values that varied most significantly among locations were those of TDS. The values obtained in the upstream regions were low and relatively similar at 1.5-2.0 ppm. However, the concentration values were equal to or higher than those recorded at two locations (2.0 ppm) and significantly higher at one other (3.5 ppm) downstream. These values indicated that runoff may contain dissolved and particulate matter being introduced into Tanana River locations. This could relate to soil particulates and bullets used by guns.

**Overall Pattern:** Looking at each measured variable, one can see that there is a definite change indicated in both pH and TDS, both being what one would have predicted if there were runoff influencing these values. Though there is no effect on temperature, both TDS and pH offer preliminary evidence of human impact on these downstream variables.

## Conclusion

A comparison between the quality of water both upstream and downstream within the Tanana River discharge area signifies that there could be an effect upon hydrological processes within the region due to runoff generated within the South Cushman Shooting Range. While there is always a possibility for error within every research project, we are confident in our data collection. Despite the similarities within water temperature, there were notable increases within both pH and TDS values. The increased values within pH signify that there is a chemical change within water, while high TDS values, particularly within the downstream samples, signify that more dissolved or particulate matter is being carried within this river system.

These trends are also what can be expected due to shooting range runoff, which can contain soil particulates, metals, or other toxins being transported into local waterways. While it is true that the amount of change observed within this study is relatively small, there is enough consistency across multiple variables to show that the South Cushman Shooting Range does impact water quality within the river. Taken together, these results demonstrate the value of continued assessment on this site. Extended sampling across seasons, including more analyses for metals and/or nitrates, could clarify whether patterns like these represent transient effects or more persistent effects on this environment. This study demonstrates that there is preliminary evidence to suggest that there could indeed be a subtle shift occurring within the Tanana River water qualities post shooting range runoff.

## Land Acknowledgment

We acknowledge that the lands on which our research was conducted are the ancestral lands of the Alaska Native nations and that we must respect the land and water as we would our own.

## Resources

Kelsey Aho – Professor of NRM 370: Intro to Watershed Management  
Craig, J., Rimstidt, J., Bonnaaffon, C., *et al.* (1999). Surface Water Transport of Lead at a Shooting Range [https://link.springer.com/article/10.1007/s001289900982?utm\\_source=getftr&utm\\_medium=getftr&utm\\_campaign=getftr\\_pilot&getftr\\_integrator=cabi#citeasLinks to an external site.](https://link.springer.com/article/10.1007/s001289900982?utm_source=getftr&utm_medium=getftr&utm_campaign=getftr_pilot&getftr_integrator=cabi#citeasLinks to an external site.)  
Darling, C. T.R., Thomas, V. G., (2003) The distribution of outdoor shooting ranges in Ontario and the potential for lead pollution of soil and water [The distribution of outdoor shooting ranges in Ontario and the potential for lead pollution of soil and water - ScienceDirectLinks to an external site.](#)  
John, P. C. (2003). Pollution hazards from sporting shooting ranges. <https://openresearch-repository.anu.edu.au/server/api/core/bitstreams/4360759a-d7d5-466d-989f-48db363f8b6c/contentLinks to an external site.>