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Effect of Lancer Park Detention Pond on Stormwater Sediment ConcentrationsÂ

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Introduction

- Detention ponds are structures designed to collect stormwater runoff, usually from developed urban areas (Goff and Gentry, 2006).
- Detention ponds remove sediment from runoff via settling to improve water quality in surrounding areas.
- Characteristics of a detention pond, such as size, shape, and detention time, impact its effectiveness at reducing sediment concentrations in stormwater (Kaini et al, 2007)
- Samples were taken over the course of three rain events and processed to determine changes in sediment concentration between inflow and outflow in the detention pond. (Färm and Waara, 2005).

Figure 1: Samples were measured out and filtered using graduated cylinders, a vacuum pump,and suction flasks.

Research Question

Does the detention pond at Lancer Park effectively reduce sediment concentrations in stormwater runoff?

Methods

- ISCO 6712 automatic portable samplers and piping attached to the detention pond was used to collect inflow and outflow samples during a rain event
- The samples were processed using the EPA method 160.2
- The samples were then weighed to measure sediment concentrations
- Data was analyzed using RStudio Software and the Mann Whitney U-Test

Results

- The detention pond produced significantly lower outflow sediment concentration as indicated by the Mann Whitney U test with a p-value of 0.7664 when using an alpha value of 0.05.
- Figure 2 is a graph showing the inflow and outflow sediment concentrations recorded throughout the first rain event, inflow levels sharply rose in the beginning with the highest concentration being 1839 mg/L. roughly five hours after the event started sediment concentrations in the inflow leveled off below the 100 mg/L range. Outflow levels remained low for the full duration, the exception being the final sample which read 247 mg/L being the highest recorded.
- Figure 3 graphs the sediment concentrations for the second rain event, once again inflow levels peaked in the first hours of the rain fall. With the highest level being 254 mg/L which is a sharp decline from peak levels recorded in the first event. The inflow levels throughout this event did did not level off as seen in the first, instead they continued to spike every few hours and were rising higher when the last sample was taken. Outflow concentrations leveled off with all but three samples reading less than 10 mg/L.
- Figure 4 graphs the sediment concentrations for the final rain event, equipment error in the inflow sampler lead to only nine samples being collected. Of those nine samples, the peak was recorded with the first sample at 138 mg/L. The other eight samples collected showed similar results to the second event, with spiking results towards the end of the event. Outflow samples were all collected as normal, the peak outflow concentration level was recorded at 38 mg/L towards the end of the sample timeframe. When compared to rain gauge data the spike in outflow happened at the same time as the rainfall heavily increased.

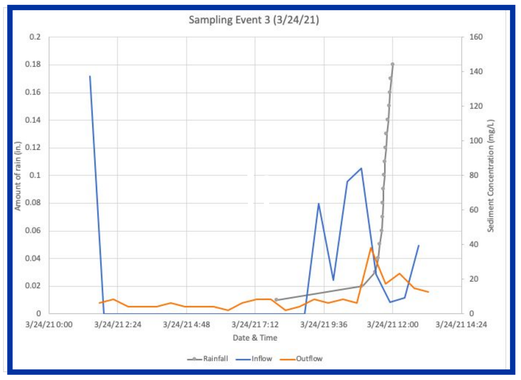

Figure 2: Inflow and outflow sediment concentration relationship with rainfall for samples taken on February 26th to 27th.

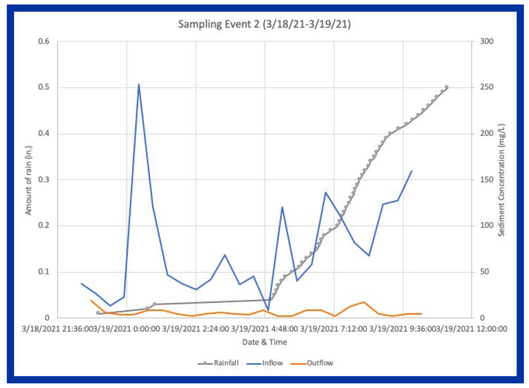

Figure 3: Data set sample 2 for inflow and outflow concentration relationship with rainfall for samples taken March 18th- 19th

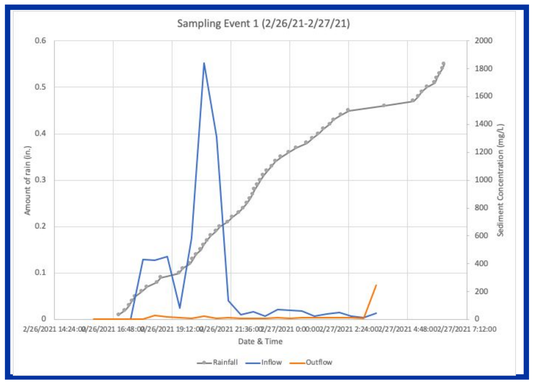

Figure 4: Data set 3 for inflow and outflow concentrations with relationship to rainfall on march 24th.

Conclusions

- It was observed that within the early stages of the rain event the peak amount of sediment concentrations was recorded in the inflow.
- As the rain event continued the recorded concentration levels for the inflow began to even out, leading us to the conclusion that most sediments were carried by the runoff towards the beginning.
- When comparing the inflow to the outflow there is a significant difference in the sediment concentrations, with the outflow being much lower.
- Figure 1 is a comparison of two samples taken at the same time, I7 from the inflow and O7 from the outflow. when looking at the samples the inflow is clearly darker and has an appearance close to gravel. however the outflow is much lighter and more clay/silt based.
- This comparison shows that the detention pond did effectively settle sediments in runoff from the parking lot and therefore increased water quality in surrounding water bodies.

References

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Acknowledgments

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