

City of Oshkosh James Road Detention Basin Phosphorus and Suspended Solids Removal Evaluation

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Purpose

The purpose of this small project was to evaluate the impact of a nonpoint detention basin on suspended solids and phosphorus reductions installed by the City of Oshkosh.

Introduction

To abate the effect of runoff from rain or snowmelt and slow down the water flowing through Sawyer Creek and its tributaries, the City of Oshkosh built a 39-acre detention basin in rural Winnebago County in 2012-2013. The detention basin, named James Road Detention Basin (JRDB), was designed with a 140-foot wide inlet spillway on the southwest side to capture storm water above a 2-year storm event to reduce the impact from runoff events (City of Oshkosh Public Works, 2013) (Photos 1-3).



Photo 1: James Road Detention Basin Under Construction. Photo courtesy of City of Oshkosh Public Works Department 2013.



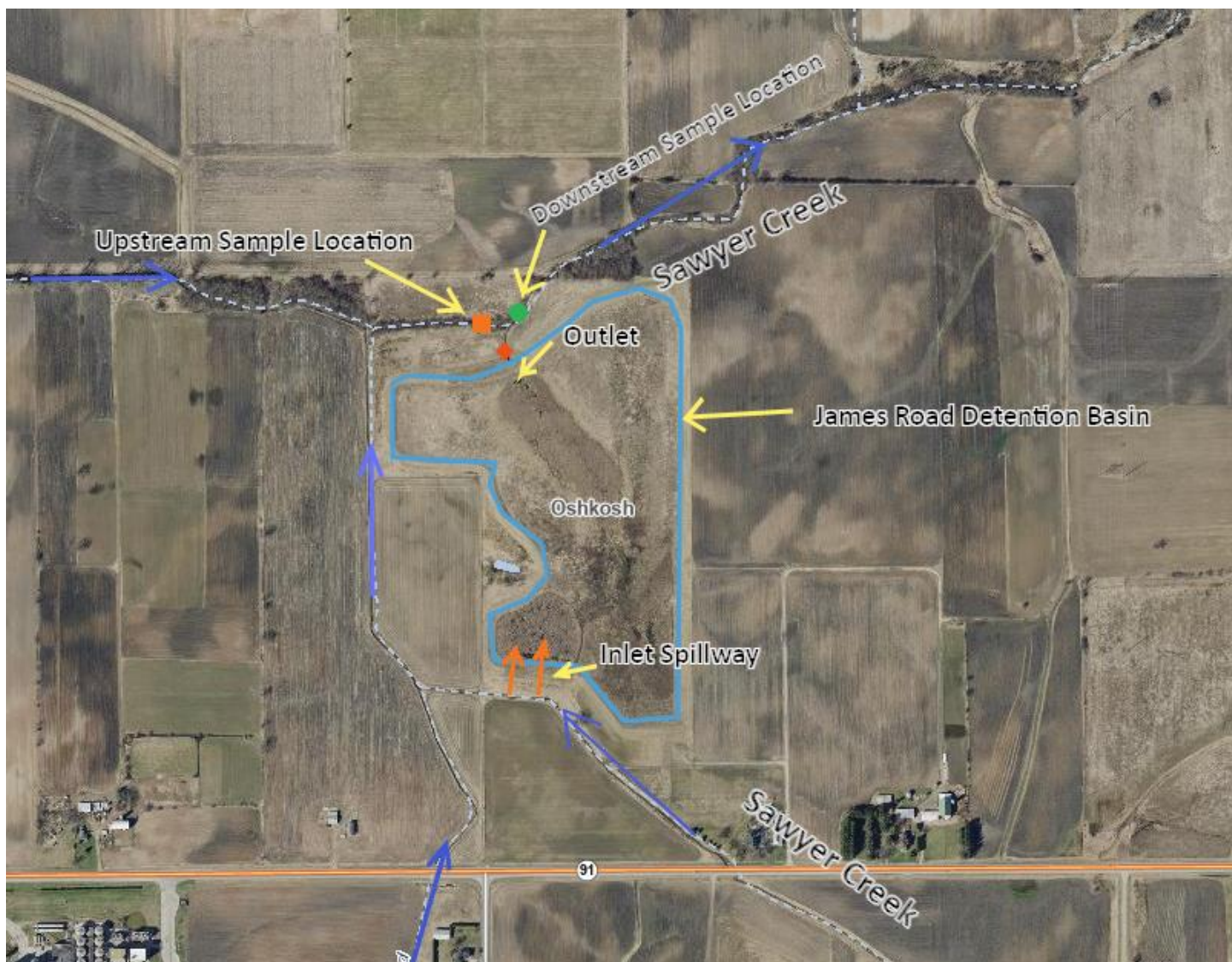
Photo 2: James Road Detention Basin Outlet Under Construction. Photo courtesy of City of Oshkosh Public Works Department 2013.



Photo 3: James Road Detention Basin After Construction. Photo courtesy of City of Oshkosh Public Works Department 2013.

During snow melt events or rain events, water flowing over the ground surface erodes the soil and carries sediment toward Sawyer Creek and its tributaries (Map 1). Sediment can negatively impact waterbodies by reducing available habitat, stressing fish and aquatic life, and increasing water temperatures. Heavy rainfall amounts in a short period increases the volume of water in the stream channels and promotes streambank erosion and flooding downstream in the City of Oshkosh. Attached to the eroded sediment, phosphorus can tag along and increase unwanted algal blooms in downstream waters.

This water quality monitoring project aimed to collect a few samples during a rain/snowmelt event or two in Sawyer Creek upstream of the detention basin outlet, from the outlet, and in Sawyer Creek downstream (Map 1).



Map 1: James Road Detention Basin and Monitoring Locations.

Method

Two sampling events occurred between August of 2022 and June of 2023 following the DNR Water Quality Monitoring Program Nutrient Chemistry Grab Sampling (V3.3) protocol (DNR 2015). Samples were collected at 3 locations (Table 1, Map 1, Photo 5-7). During or after a heavy rain event was the targeted monitoring event; however, very few significant ($>1''$ in 24 hours) storm events occurred in the Summer of 2022 and Spring of 2023.

Location Description	SWIMS Station #
Sawyer Creek Upstream Retention Basin Outlet	10056817
James Road Retention Basin Outlet	10056816
Sawyer Creek Downstream Retention Basin Outlet	10056815

Table 1: Sample Locations at the James Road Detention Basin.

Instantaneous water chemistry information was also collected during the sampling event on June 12th, 2023, using a Hydrolab MS5 multiparameter meter. Water temperature, pH, Dissolved Oxygen concentration and % Saturation, and Specific Conductance were collected. Transparency of the water was measured with a 120-centimeter water clarity tube (Photo 4).



Photo 4: Water Clarity Tube. Photo taken by D. Bolha on February 15th, 2022.

Results

The total phosphorus (TP) concentrations collected during these monitoring events ranged from 0.0838 mg/L on June 12th, 2023, in the retention basin outlet to 0.586 mg/L on August 9th, 2022, in Sawyer Creek downstream of the retention basin outlet. The TP levels in Sawyer Creek were significantly higher than the outlet of the retention basin, both in August 2022 and June 2023 (Table 2, Chart 1). The TP and Dissolved Orthophosphates (PO₄) were comparable from upstream to downstream in Sawyer Creek. In Sawyer Creek, the %PO₄ form of phosphorus ranged from 64% to 75% of the TP. The retention basin outlet %PO₄ form of phosphorus ranged from 43% to 68% of the TP. The suspended solids (TSS) ranged from 17.6 mg/L in Sawyer Creek downstream of the retention basin on August 9th, 2022, to 4.2 mg/L in the basin outlet on August 9th, 2022 (Table 2, Chart 2).

	Sawyer Creek Upstream	Sawyer Creek Upstream	Retention Basin Outlet	Retention Basin Outlet	Sawyer Creek Downstream	Sawyer Creek Downstream
Parameter	8/9/2022 Results	6/12/2023 Results	8/9/2022 Results	6/12/2023 Results	8/9/2022 Results	6/12/2023 Results
Total Phosphorus (mg/L)	0.581	0.13	0.137	0.0838	0.586	0.123
Dissolved Ortho-phosphorus (PO ₄) (mg/L)	0.377	0.0949	0.0932	0.0358	0.375	0.0926
Total Suspended Solids (mg/L)	15.2	4.6	4.2	13.6	17.6	13.8
Water Temperature (°C)	--	13.5	--	15.4	--	13.5
pH	--	7.9	--	7.3	--	8.1
Dissolved Oxygen (mg/L)	--	10.8	--	4.4	--	10.4
Dissolved Oxygen % Saturation	--	107.8	--	44.9	--	102.6
Specific Conductivity (µS/cm)	--	794	--	711	--	787
Water Clarity (cm)	--	120	--	120	--	120

Table 2: Water quality and chemistry monitoring results at James Road Detention Basin.

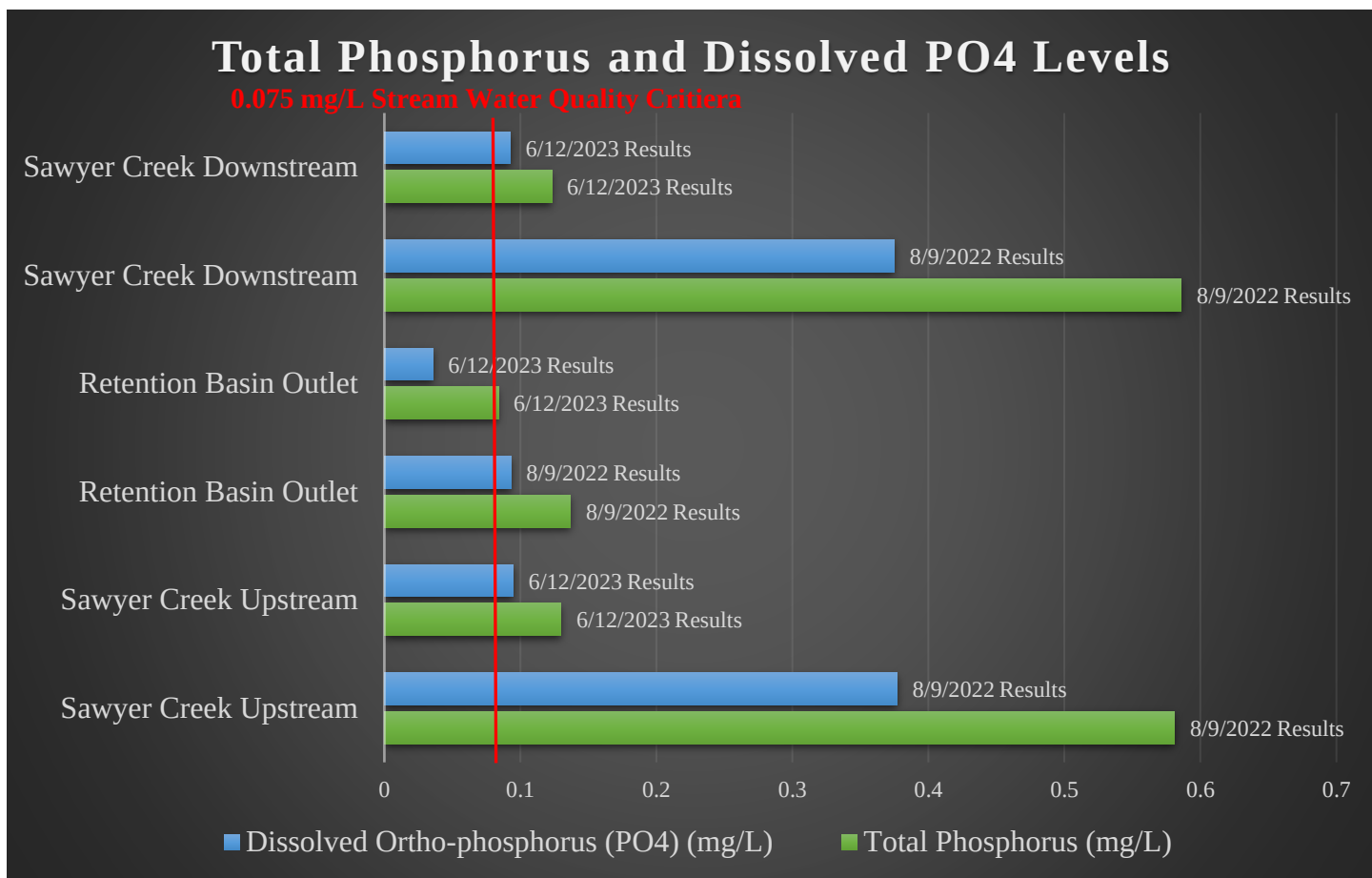


Chart 1: Total Phosphorus and Dissolved Orthophosphate Levels at James Road Detention Basin.

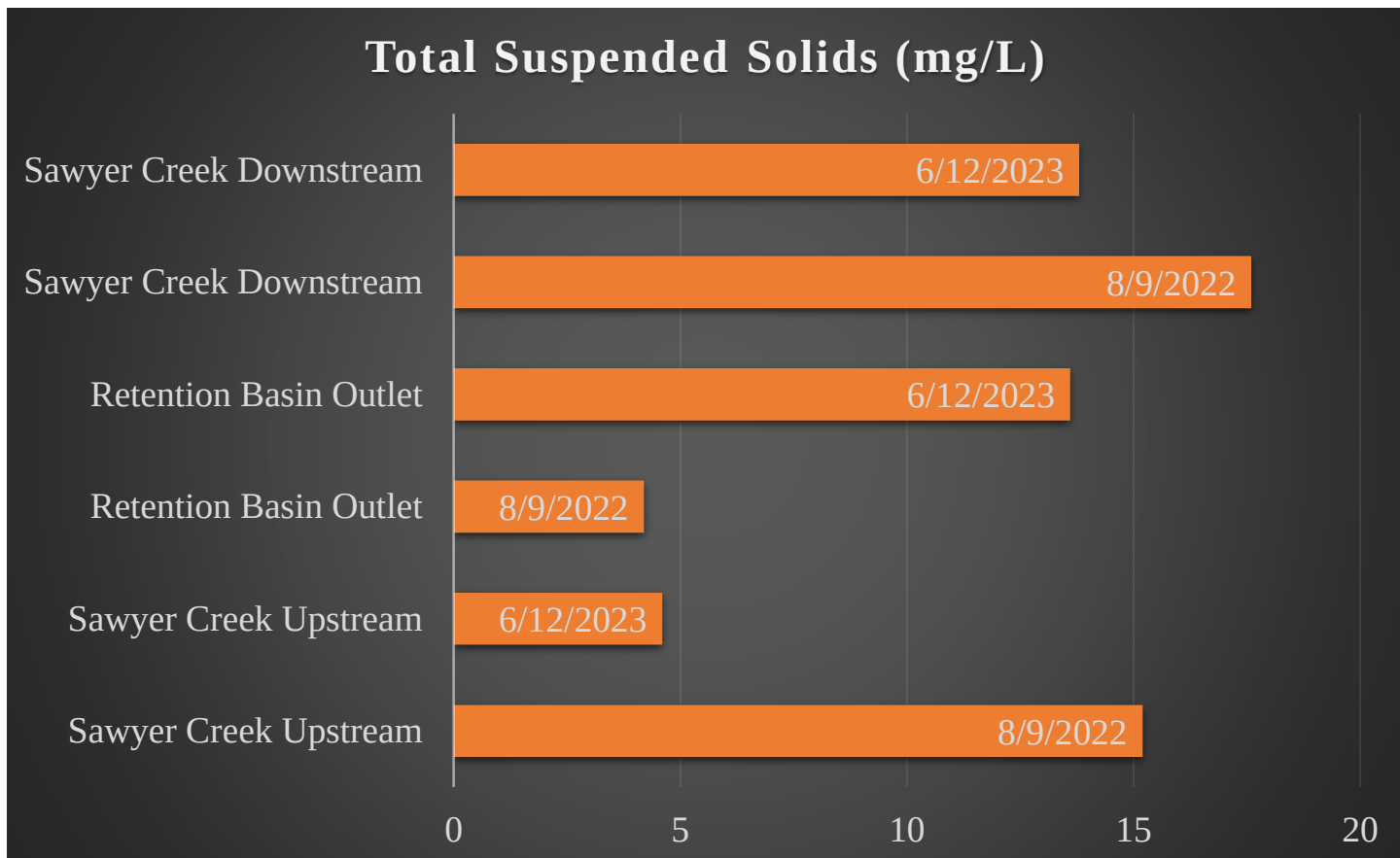


Chart 2: Total Suspended Solid Levels at James Road Detention Basin.



Photo 5: James Road Retention Basin at time of June 12th, 2023, monitoring event. Photo taken by D. Bolha.



Photo 6: James Road Retention Basin Outlet at time of June 12th, 2023, monitoring event. Photo taken by D. Bolha.



Photo 7: Sawyer Creek Upstream of the James Road Detention Basin. Photo taken by D. Bolha on June 20th, 2022.

Discussion

As more efforts are made in the Oshkosh area and the Fox-Wolf River Watershed to slow down the rain and snowmelt events and reduce sediment erosion, municipalities and partners will continue to install retention basins. Retention basins are designed to slow down the water, give the sediments and attached phosphorus a chance to settle out of the water, and, thereby, discharging cleaner water back into streams and rivers at a slower rate. Based upon the small sample size in this study, the James Road Detention Basin is sequestering sediment and phosphorus. Both TP and PO₄ were lower coming out of the basin when compared with the levels in Sawyer Creek (Table 1, Chart 1). Additionally, the percent of TP in the form of PO₄ dissolved in the water column did not increase in the water coming out of the basin. There is some concern that through the natural processes of a retention basin, particulate phosphorus is being converted to PO₄; although that was not what this project found. The PO₄ form of phosphorus is readily available to plants and algae. Converting TP to PO₄ could lead to excessive plant growth and/or increased intensity or frequency of algal blooms in the downstream waters.

The conclusions from this project are limited by the small number of samples and the uncharacteristically few storm events during the monitoring seasons of the project. To better assess the influence of the James Road Detention Basin on runoff events in the Sawyer Creek Watershed, more intense monitoring is recommended during a season where more frequent 2-year or greater storms occur.

Acknowledgements

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References

City of Oshkosh Public Works. 2013. City of Oshkosh Storm Water Utility Interactive Map of Storm Water Projects. <https://www.oshkoshwi.gov/StormWaterUtility/>

WDNR. 2015. Nutrient Chemistry Grab Sampling Method V3.3.