2021 Buckeye Lake Watershed Monitoring Summary Report

February 1st, 2022

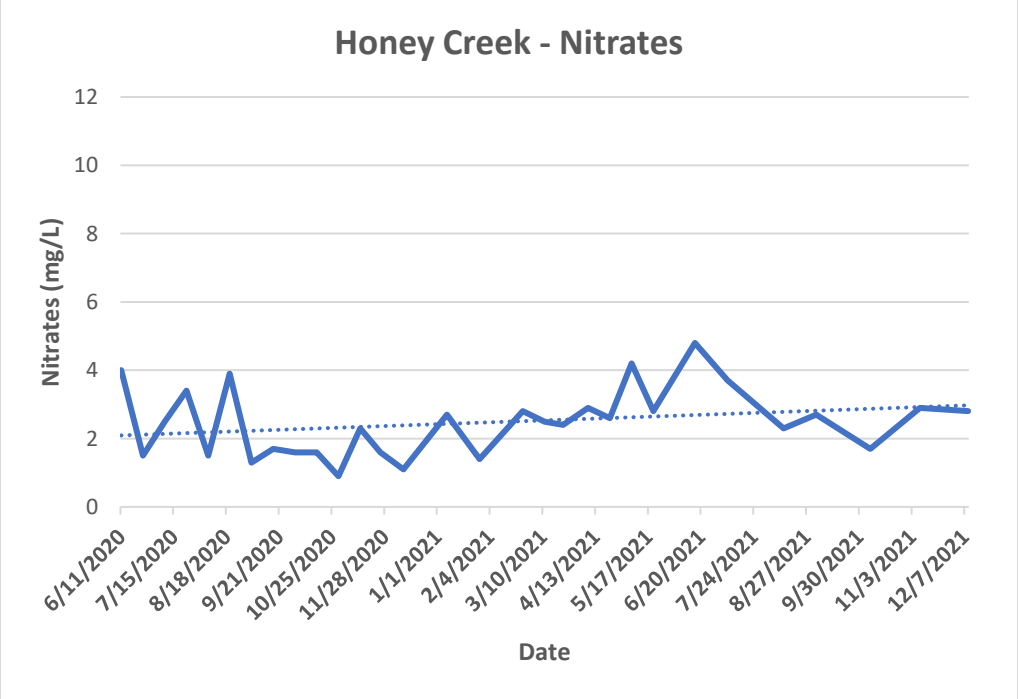
Introduction

Buckeye Lake Watershed sampling began early June 2020 and was conducted every two weeks for one year. With that base line now recorded, sampling has continued on a monthly schedule. This summary report covers testing in both 2020 and 2021 to assess whether there is additional evidence to support annual trends. The monitoring equipment used includes portable colorimeters for nitrates and phosphates and a YSI for standard parameters (pH, temperature, dissolved oxygen, and conductivity). Data has been continuously compiled in an Excel file, and a summarized version of results is presented here. Because pH, temperature, dissolved oxygen, and conductivity were all at expected levels throughout the sampling period, these summaries focus on the nutrients that more adversely affect Buckeye Lake's water.

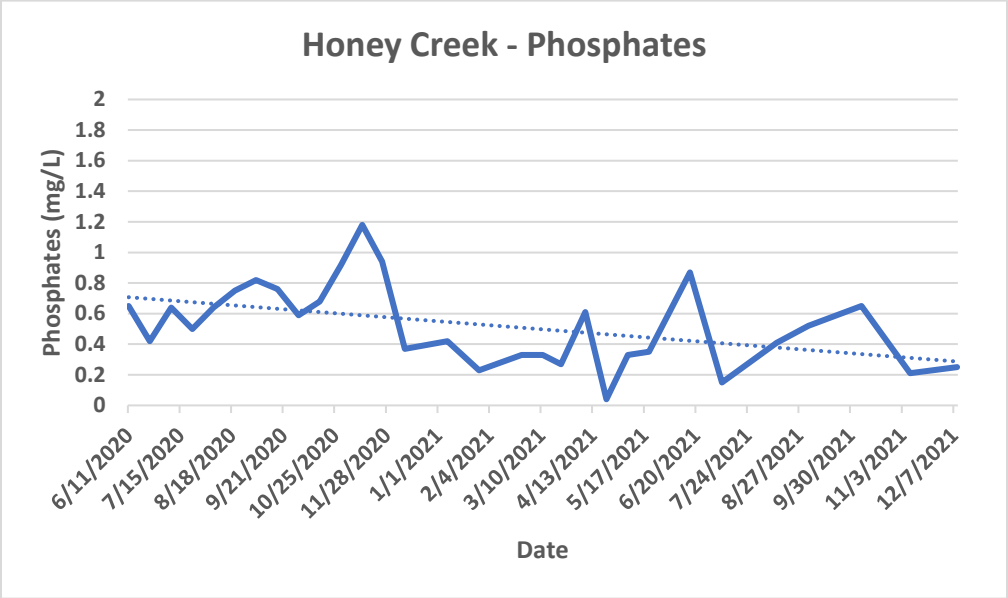
Summaries

Honey Creek (HC104):

Nitrates tend to increase in warmer months at Honey Creek with a slight dip between September and February. Summer 2021 saw higher consistent nitrates compared to the same time last year.

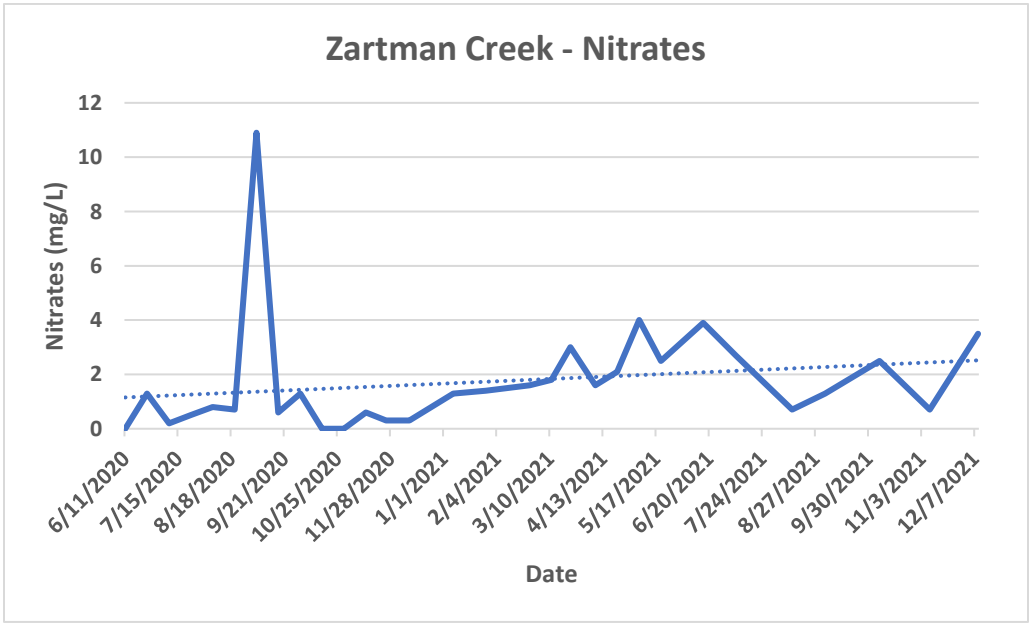


Phosphates were at their highest during fall 2020. After a couple of spikes in the spring and summer, the high fall concentrations were seen in 2021 too.

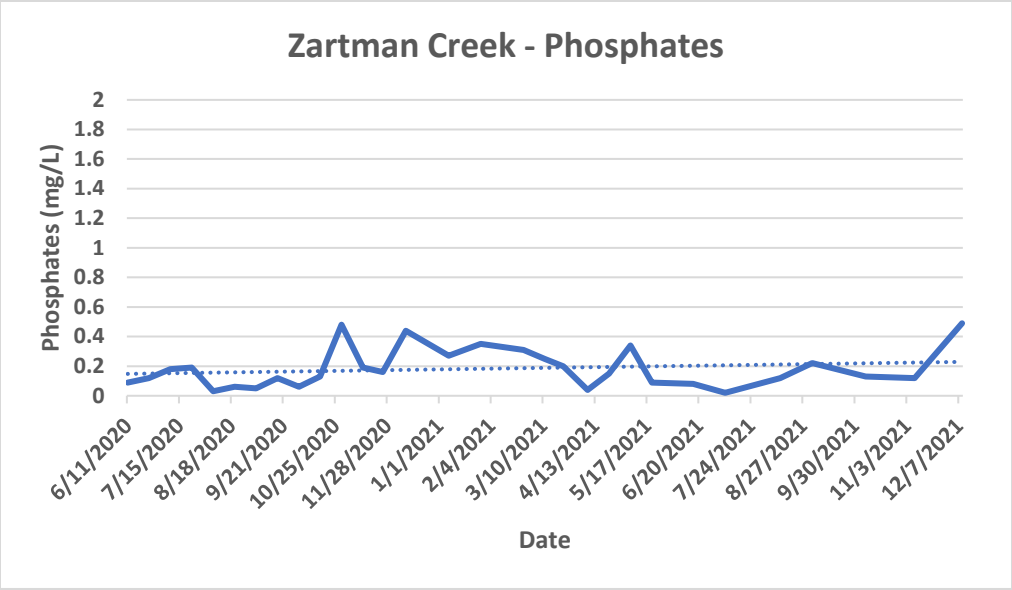


Zartman Creek (ZC105):

Ignoring the September 2020 outlier, nitrates were steady throughout the year until spring when they begin to increase. Outside of a couple of drop-offs, nitrates remained elevated in fall and winter 2021 compared to the year before.

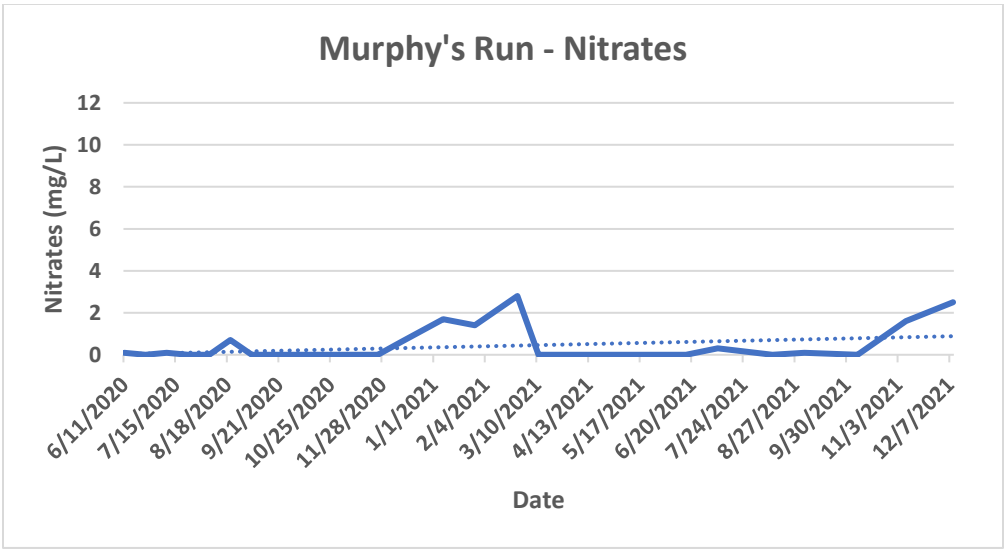


Phosphate concentrations were similar to Honey Creek: higher in the fall with a small spike in the spring.

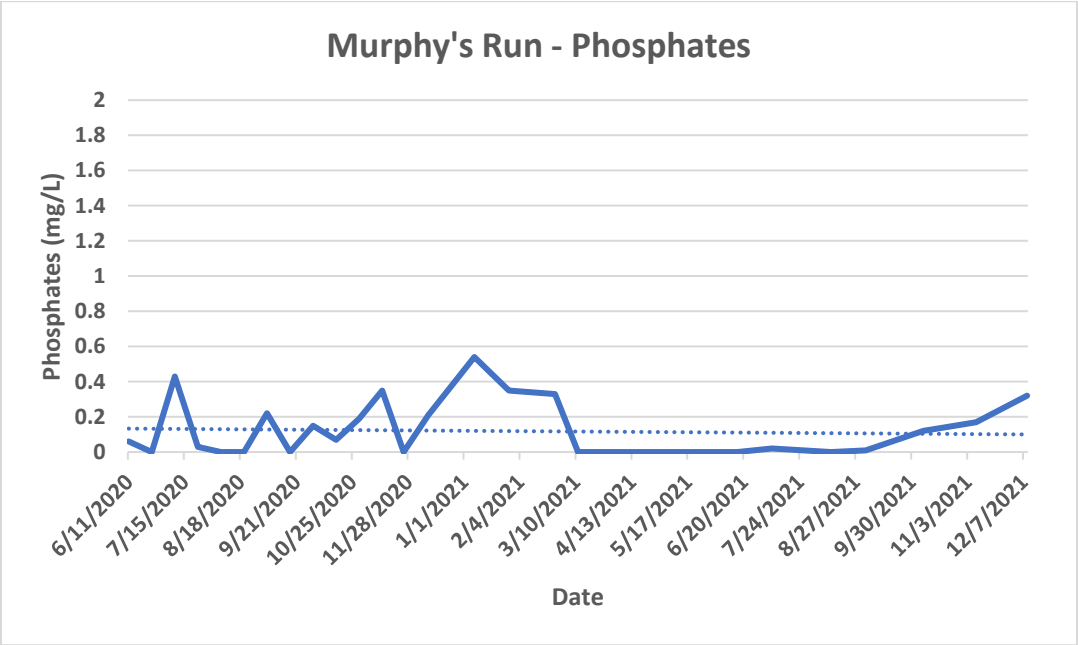


Murphy's Run (MR106):

Nitrates started to increase in late winter 2020 but recordings stopped at the beginning of March due to ODNR's wetland construction at Brooks Park. Sampling resumed after construction was completed in June. Nitrate levels were consistently too low to detect until late fall/early winter 2021. The sudden increase matches the increase seen during the previous winter.

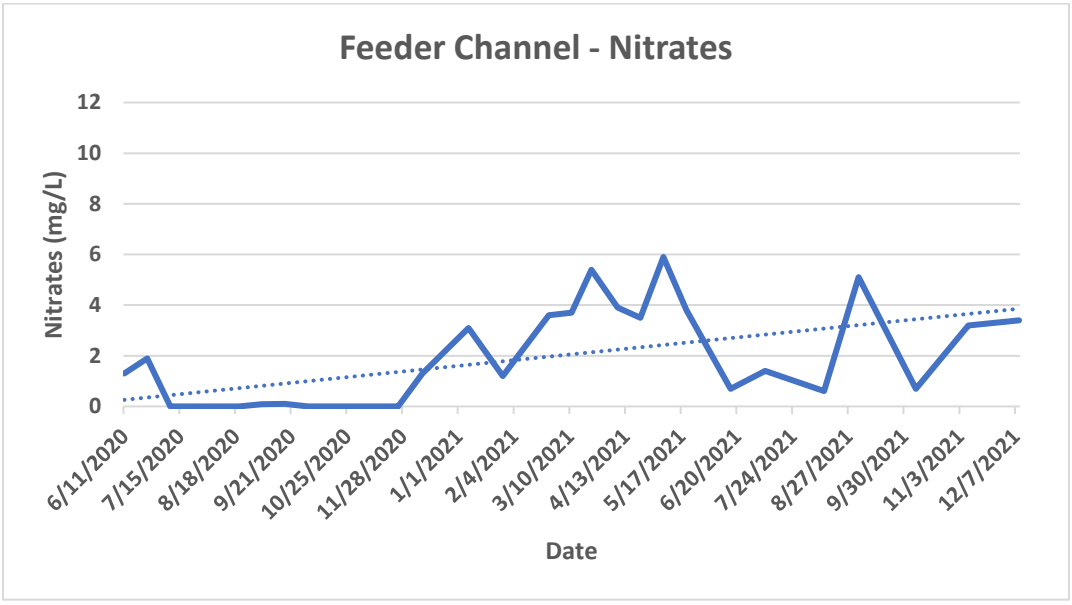


Phosphates also increased at the same time that the nitrates did, elevated during the late fall and winter, while showing lower concentrations in the summer. The summer reduction does not match between 2020 and 2021 in this case. Summer 2020 showed more erratic behavior.

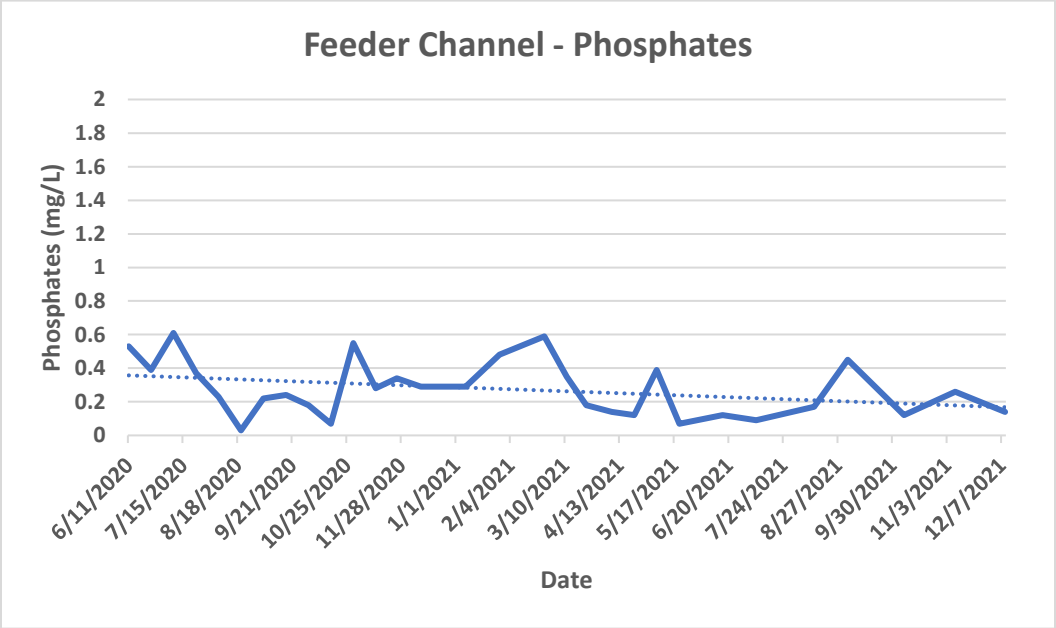


The Feeder Channel:

Nitrates increased substantially in early 2021 and continued their upward trend throughout the spring. Concentrations dropped slightly mid-summer but never to the undetectably low concentrations of summer 2020. There is still a slight upward trend for the colder months of 2021.

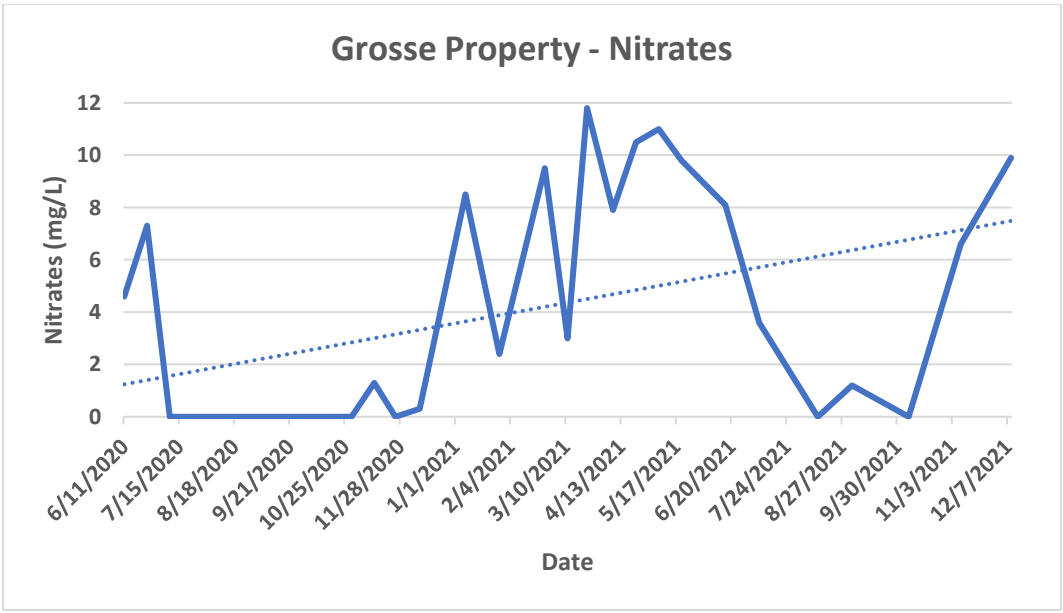


Phosphates behaved erratically in the Feeder Canal and did not show the steady winter/spring 2021 rise that nitrates did, although the elevated September and November 2021 results do match.

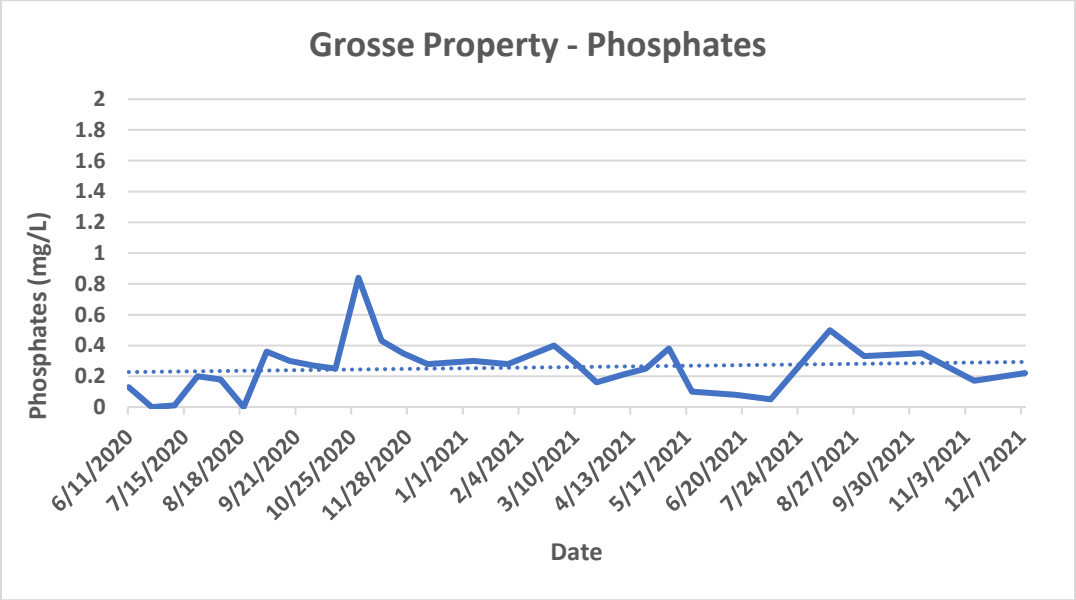


Grosse Property Ditch (GB103):

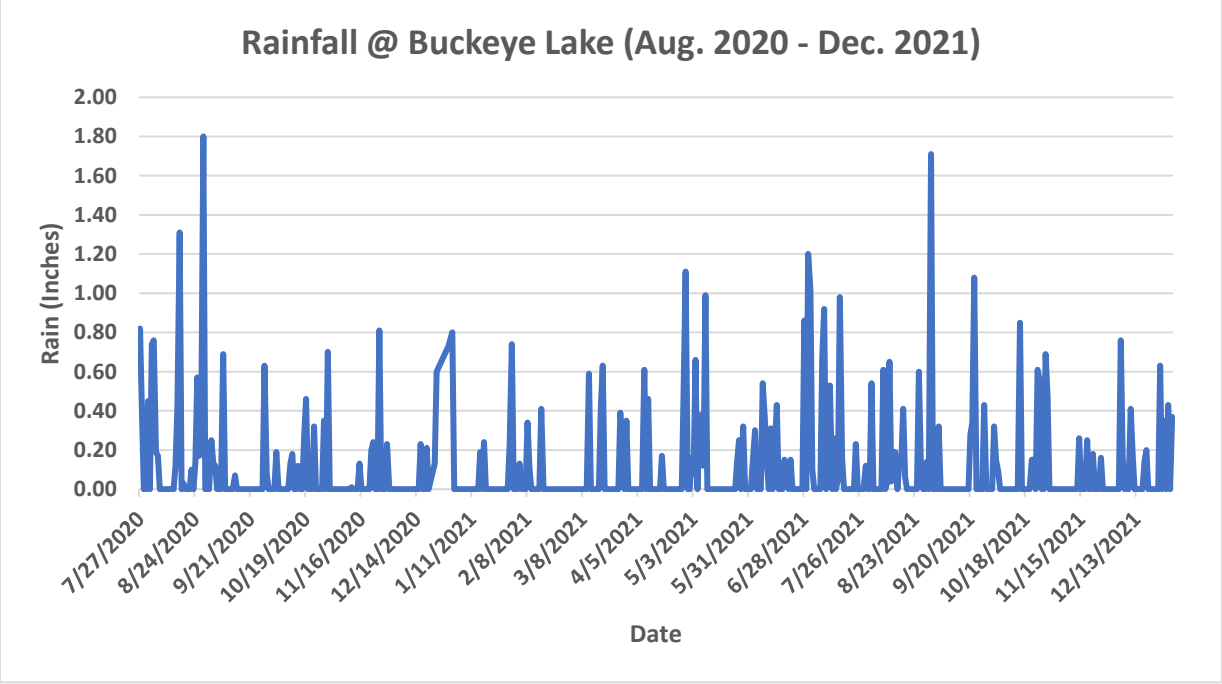
The Grosse property had the highest nitrates in the watershed. Winter and spring time saw some massive jumps in nitrate concentrations after a lower summer/fall. This pattern was seen in both 2020 and 2021.



Phosphates measured at Grosse Point do not fluctuate to the extent that nitrates do, and concentrations are comparable to other locations in the watershed. The nutrient runoff here releases an abnormally high concentration of nitrates compared to phosphates.



Rainfall



Rainfall at Buckeye Lake was highest toward the end of the summer (seen in both 2020 and 2021), with occasional high events in the autumn and winter months. Spring rains were elevated but not as much as

the summer events. These periods of heavier rain match observed nitrate and phosphate spikes at several of the sampling locations.

About the Results

The US EPA is currently revising Ambient Water Quality Recommendations for Lakes, which help states set limits for nitrate and phosphate loads in lake waters. The last update happened 20 years ago. In the meantime, the State of Delaware has set water quality thresholds that help make sense of these nitrate and phosphate recordings. According to their calculations, phosphates should ideally be less than 0.03 ppm (mg/L) because <0.03 ppm supports aquatic vegetation. 0.05 ppm (mg/L) and higher begins to negatively affect fish and macroinvertebrates. Exceeding 0.10 ppm activates explosive algae growth. Nitrates activate algal blooms at 3 ppm (mg/L) or higher. 10 ppm is the limit for drinking water and 20 ppm starts to kill off aquatic life.

The sites sampled had nitrate readings near or above 3 mg/L at least once, some topping the threshold more often than others. Among these, Honey Creek and the Grosse property pose the most threat of consistently introducing algae-causing nitrates to Buckeye Lake. The Feeder also contributes a good portion of them, especially recently.

Phosphates, too, generally exceeded the State of Delaware's <0.05 mg/L recommendation for algae prevention. The sites in frequent violation were Honey Creek, the Feeder, and the Grosse property.

Conclusions

When considering the base line data collected from summer 2020 to summer 2021, data collected in the second half of 2021 supports identified trends. Higher nitrate concentrations at Honey Creek in the spring and summer, higher phosphate concentrations in the fall; higher nutrients at Murphy's Run and the Feeder Canal in the winter; big nitrate rises at the Grosse property in the winter and spring. Tracking these trends is important, but only for the sake of watching them change when conservation practices are used to mitigate nutrient runoff. The data collected in 2021 only goes as far as showing that Buckeye Lake's target areas remain Honey Creek, the Feeder, and the discharge passing through the Grosse property. Projects are already in development in the watershed, but sampling trends are likely to stay steady until projects are completed and have been impacting the watershed for a measurable amount of time.

It must also be noted that other sampling was conducted in the watershed in 2021: Copper Penny Canal behind Flip Flops, in which a bubbling aerator was installed, and additional points on Honey Creek to assess how nutrients fluctuate along the tributary's reach. There is not enough data points from the Copper Penny Canal to produce a graph. Ongoing monitoring at this site is needed. Likewise, monitoring Honey Creek at several upstream locations will need to go on longer before being able to have a big enough sample size to identify trends in nutrient runoff.

References

Background Information for Interpreting Water Quality Monitoring Results.

http://www.dnrec.delaware.gov/fw/Education/Documents/AREC/Water%20quality%20interpretation%20guides.pdf

Draft Ambient Water Quality Criteria Recommendations for Lakes and Reservoirs of the Conterminous United States: Information Supporting the Development of Numeric Nutrient Criteria

https://www.epa.gov/sites/production/files/2020-05/documents/draft-ambient-wqc-recommendations-lakes-2020.pdf

Understanding Units of Measurement.

https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.files/fileid/14285#:~:text=For%20water%2C%201%20ppm%20%3D%20approximately,equal%20to%206%2C000%20ug%2FL.