

Pine River Watershed and Van Etten Lake 2025 Phosphorous and Suspended Solids Monitoring

SUMMARY

The Pine River at the county line and the Van Etten River (Lower Van Etten Creek) where it leaves the lake continues to be monitored annually to determine the relative impact of upstream and lake shore nutrients and solids. Sampling on the South, West and East Branches is also being done annually.

The estimated amount of phosphorus - P (17.1 lbs/day) entering the lake from the Pine River for the sampling year 2025 was about 110 percent of the estimated ten-year mean amount. The estimated amount of total suspended solids - TSS (5.15 tons/day) entering the lake was about 107 percent of the ten-year mean. Both estimates are based on a regression method approach.

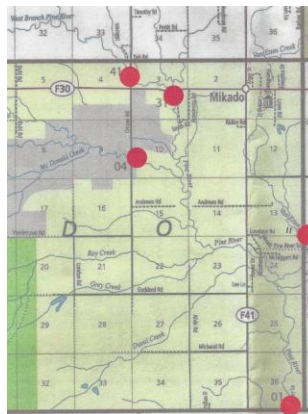
The P and TSS estimated amounts at the outlet from Van Etten Lake at the dam based on regression analysis were (12.9 lbs/day) 70 percent of the ten-year average and (0.57 tons per day) 61 percent of the ten-year average respectively.

TRIBUTARY STREAM SAMPLING PROGRAM OVERVIEW

P sampling was continued in 2025 using the Prein&Newhof Laboratory of Grand Rapids. No TSS sampling was conducted again in 2025. Stage levels were determined at six locations throughout the sampling season. The Pine River at the county line and the Van Etten River (Lower Van Etten Creek) where it leaves the lake continued to be monitored to determine the relative impact of upstream and lake shore nutrients and solids.

The water level (stage) measurements taken were used to estimate the flow at the time of measurement. Measurements were collected during both high flow and low flow conditions from April through October in an attempt to characterize the quantity and quality of inflows in the system. Where direct sampling results were not available, regression analyses were used to estimate the amount of P and TSS in the stream at each flow measurement time.

Figure 1 – Flow Measurement Locations



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RESULTS

The results of this analysis are summarized in Table 1 below.

Table 1
2025 Pine River Tributary Sampling Results

	Flow		Phosphorus		Total Suspended Solids	
	CFS	%	#/Day	%	tons/day	%
South Branch	53	52%	4.1	52%	6.76	46%
East Branch	20	20%	1.0	13%	2.00	13%
West Branch	22	22%	1.9	23%	3.75	25%
Van Etten Creek	6	6%	0.9	11%	2.30	16%
Pine River @ Co Line	126		17.1		5.15	
		% of mean	105%	% of mean	105%	
Tributary estimates for balance (not including Duvall Creek)						
	102	81%	7.9	46%	14.81	288%
Van Etten River below Dam	105		12.9		0.57	
		% of mean	82%		70%	
E/W at F-30	42					

The combined estimated flow from the tributaries was approximately 19% less than the estimated flow for the Pine at County Line Rd. The estimated P for the tributaries was 54% less than the estimate for the Pine at County Line Rd. The estimated TSS for the tributaries (287% greater) indicate that estimates for the Pine at the county line are still not in agreement. There is a possibility that solids were being deposited between the sampling points at the times of sampling which would account for the wide discrepancy in the TSS results. It is also a possibility that higher flows occurring between sampling times carry proportionately more TSS in the Pine River than in its tributaries. However, the source of the imbalance is not readily apparent.

The stage/flow curves being used are based on measurement of the discharge at each location using standard velocity and area measurement techniques along with water level measurements taken at the same time. The stage/flow curves, the sampling location details and a summary of stream flow measurement and sampling methods used are available on request as an appendix to this report.

A summary of the estimated quantities of phosphorus (P) and total suspended solids (TSS) contributed to the lake by the Pine River and the other tributaries are shown in Figures 2 and 3. The estimated quantity calculations are based on the geometric mean estimates as the quantities estimated during relatively infrequent high flow periods tend to skew the arithmetic mean to the high side. Both the P and TSS estimates for 2025 are based on a regression analysis using the readings from the Crowd Hydrology gauges.

The data for 2025 show that P leaving the lake was 113 percent of the amount entering from the rivers and streams River based on the regression analyses. Also, based on the regression analysis, the TSS leaving the lake was only 20 percent of the TSS entering the lake via the Pine left through the dam. It could be as low as 6 percent if the estimated TSS of 22.7 tons/day from the upstream tributaries is used. The reduction is not unexpected due to the settlement of solids during the flow through the lake. The estimated amount of P entering the lake was 17.1 lbs/day, 110 percent of the ten-year mean, and the estimated amount of TSS was

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5.15 tons/day, 107 percent of the ten-year mean which includes an estimate of the contribution from Hill Creek. The Pine River continues to be the major contributor of both P and TSS to the lake.

The estimated flows and the P (12.9 lbs/day), 137 percent of the 10-year average and TSS (0.57 tons/day), 163 percent of the 10-year average amount leaving Van Etten Lake were within the normally expected range based on the historically observed values.

Figure 2

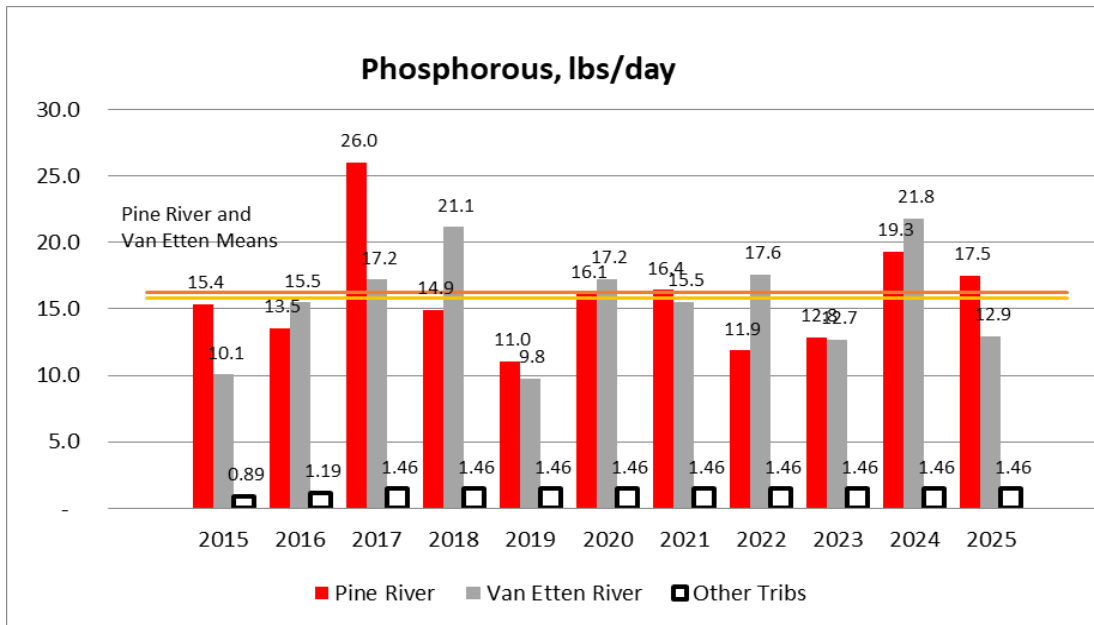
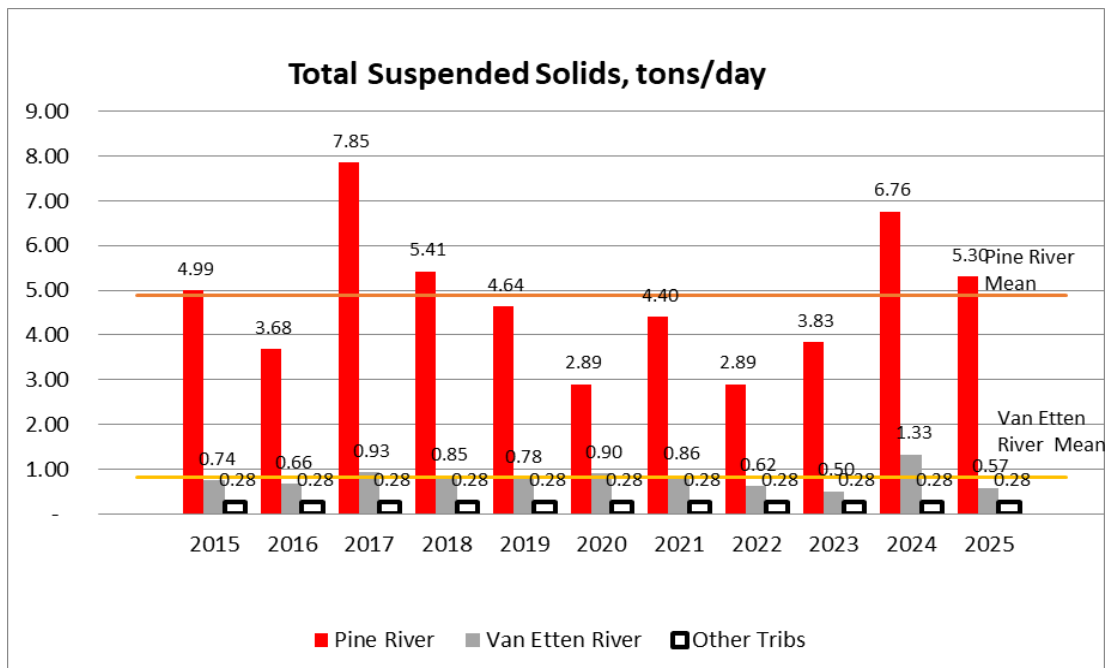


Figure 3



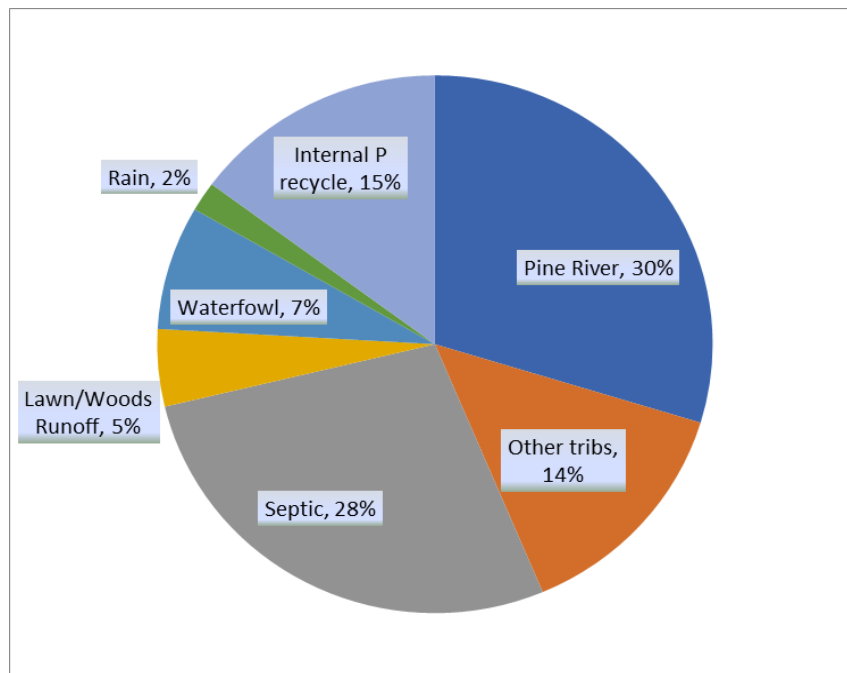
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NUTRIENT AND SEDIMENT LOADINGS TO VAN ETTEN LAKE

Nutrients and sediments can enter Van Etten Lake through stream input, overland flow, ground water seepage and within lake processes. The McNaught study and this sampling are designed to assess stream input. The Pine River, Huron (Sims) Creek, Phalen Creek, Coppler Creek, Hill Creek (west of the Pine on County Line Road) and Dry Creek (near Colbath Road) add nutrients and sediments directly to Van Etten Lake. The total contribution from each stream depends on the concentration of nutrient or sediment in the stream and the rate of stream flow (discharge). The contribution from each stream, called "load", is calculated as pounds or kilograms per day. Streams with high concentrations and high discharge will contribute the most nutrients and sediments to the lake. The Pine River is the primary source of nutrients and sediments. By also measuring the water that flows out of the lake for nutrients and sediments, the total contribution (or deduction) from non-stream related sources (runoff, seepage and within-lake processes) can be estimated. Most of the sediments entering the lake are carried by the inlet streams following storm events. After stream water enters the lake, sediment quickly settles to the bottom as the velocity decreases. Many of the settling particles have phosphorous and nitrogen bound to their surface. These attached nutrients become part of the stored nutrient pool at the bottom of the lake.

The current estimates of phosphorus to the lake from all sources are summarized in Figure 3. These are estimates from a mass balance model for the lake which will continue to be refined as additional sampling is completed.

Figure 3
Estimate of Phosphorus Contributions
To Van Etten Lake by Source



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OBSERVATIONS

1. The Pine River is by far the major contributor of P and TSS to the lake. The indications are that the bulk of P and TSS are carried to the lake during spring melt runoff and during rain events. The estimated contribution from septic system flows going into the water table through phosphorus saturated soils and improperly operating systems is the second largest contributor of phosphorus to the lake
2. Over the long term, the amounts of TSS leaving via the Van Etten River are significantly less than the amounts entering from all sources. The difference is due to settlement of solids after they enter the lake.
3. Limited Total Phosphorus sampling will be conducted in 2026 using the services of the Prein & Newhof Laboratory of Grand Rapids, Michigan.
4. Water level readings and previous regression analysis will again be used to estimate the P and TSS quantities in the system for 2026.