

**Current State of PCB Contamination  
in Kalamazoo Lake and Harbor  
Surface Waters and Sediments**

**Summary Report Prepared by:**

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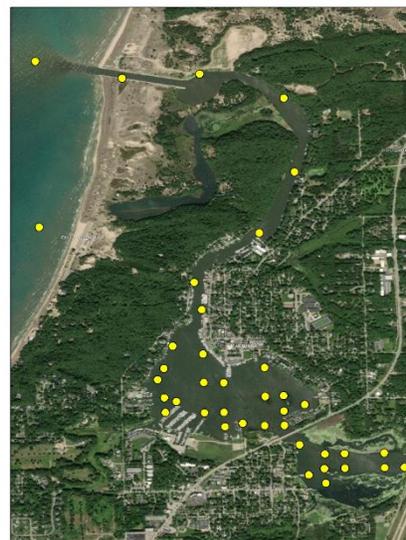
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The United States EPA designated the Kalamazoo River as an Area of Concern (AOC) and Superfund site as a result of historic polychlorinated biphenyl (PCB) contamination, largely from paper mills operating along the river from the 1950s to the 1970s. The AOC/Superfund site extends along 80 miles of the Kalamazoo River, from Lake Michigan to Morrow Dam in Kalamazoo County. Kalamazoo Lake in Allegan County is the last inland body of water along the Kalamazoo River before it flows out to Lake Michigan.

In 2019, the Michigan Tech Research Institute (MTRI) was awarded a grant by the Michigan Department of Natural Resources (MDNR) to characterize the hydrology of Kalamazoo Lake and Harbor in support of recreational boating. Included in the statement of work was a comprehensive re-sampling of PCB sediment contamination in the region, similar to an effort undertaken in 2000. This report will summarize the results of the 2019 sampling effort to investigate whether any surface sediments currently contain PCBs at a level of concern, how contamination levels have changed from 2000 to the present, and how PCB contamination has been redistributed in the vertical soil profile. An additional analysis will look at how PCB contamination in the surface water has changed since 1999.

The 2019 sediment sampling effort took place from July 15-19, 2019 and included sediment cores from 39 sites (Figure 1). Cores were collected as deep as the sediment would allow and were sliced into discrete depth intervals (0-2", 2-6", 6-12", and every 12" to maximum depth). In total, 184 slices were collected from the 39 sites. These samples were sent to ALS Environmental (Holland, MI), where moisture content and PCB concentration were analyzed for each of the samples. Total PCB concentrations were evaluated against the regulatory limit of 1 ppm established by the EPA's Toxic Substances Control Act (1976).

Of all the sites sampled in 2019, only one (SS-15, located off of Wade's Bayou Memorial Park in Douglas, MI) had detectable PCB concentrations in the top 2" of soil and that concentration (0.160 ppm) was well below the regulatory limit. None of the sampled sites revealed concentrations above 1 ppm in the top 6 inches of sediment. Only five sites had PCB concentrations exceeding the regulatory limit anywhere in the sediment depth profile: KL-38 (12-24": 2.1 ppm), KL-54 (24-34": 3.96 ppm), KL-61 (12-24": 1.2 ppm; 24-36": 1.3 ppm; 36-48": 3.2 ppm), KL-75 (6-12": 1.2 ppm), and SS-15 (6-12": 1.3 ppm). The locations of these sites can be seen in Figure 2a. Figure 2b shows the 25 sampling stations from the 2000 sampling effort where the PCB concentrations in at



*Figure 1: Locations of sediment sampling sites for 2019 effort.*

least one of the depth samples exceeded 1 ppm. Across sites sampled in both 2000 and 2019, the 2000 sampling effort had three sites with concentrations above the regulatory limit in the top 6 inches, and two within the top 2 inches, both in the vicinity of the Tower Marina docks.

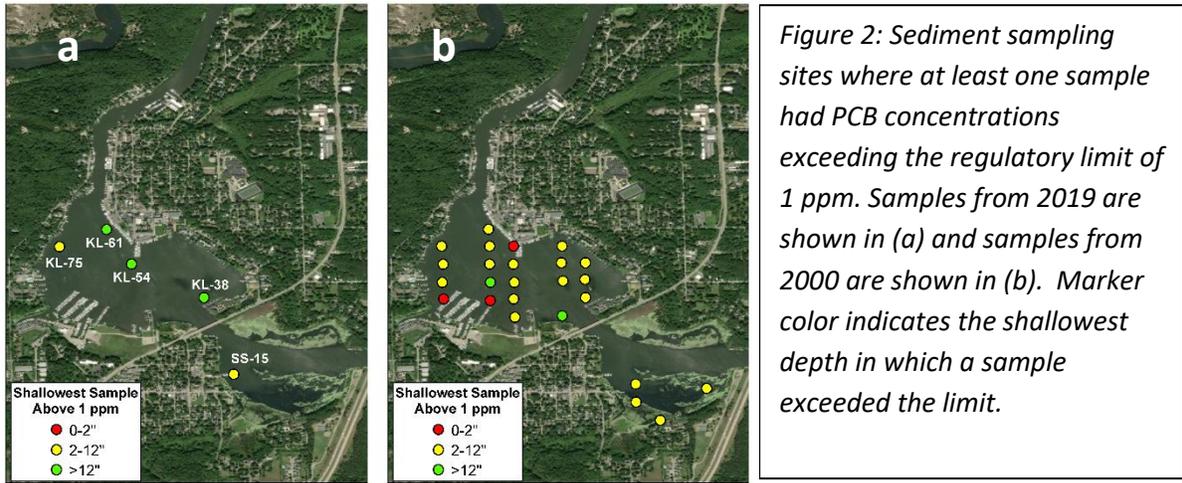


Figure 2: Sediment sampling sites where at least one sample had PCB concentrations exceeding the regulatory limit of 1 ppm. Samples from 2019 are shown in (a) and samples from 2000 are shown in (b). Marker color indicates the shallowest depth in which a sample exceeded the limit.

Of the five stations shown in Figure 2a, four were sampled as part of the 2000 effort and they all exceeded the regulatory limit then as well. Figure 3 shows the vertical soil profile of PCB contamination for the five 2019 sampling stations exceeding regulations, along with the profile from 2000 where possible. These plots show that not only were the PCB concentrations generally higher in 2000, but the elevated concentrations have shifted deeper in the profile as new sediment from upstream is deposited on top of the contaminated sediments. Site KL-75 is the exception, with no deep PCB contamination layer in 2019. This site is located along the dredged path from Lake Michigan to Tower Marina, so the deeper contaminants observed in 2000 may have been removed in the dredging process.

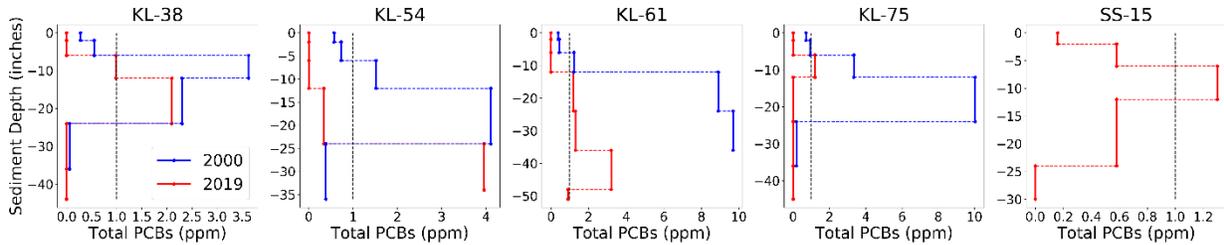


Figure 3: PCB contamination profiles for the sampling sites where PCB samples from 2019 exceeded the regulatory limit of 1 ppm: KL-38, KL-54, KL-61, KL-75, and SS-15. Profiles from 2019 are shown in red, and where possible, profiles from 2000 are in blue.

In addition to the sediment sampling efforts, surface water samples were collected and analyzed for PCB concentrations from a site near the Blue Star Highway overpass (42.648, -86.199) multiple times per year from 1999 through 2015. The mean annual PCB concentration was calculated and assessed to investigate change over the sampling time period. In the case when no PCBs were detected, the concentration was set to equal the

minimum detection limit (0.2 ppt for 1999-2011 and 1 ppt for 2012-2015). The EPA maximum contaminant level (MCL) for PCBs in drinking water is 0.5 ppb (500 ppt) and 0.17 ppt for streams and lakes from which people drink water or eat fish, however the goal is for zero contamination.

Figure 4a shows the mean concentration of surface water PCBs for each year sampled. The observed concentrations have steadily declined since the peak in 2004 of nearly 12 ppt. Note that in the last four years sampled (2012-2015), the mean concentration has stabilized at 1 ppt. Figure 4b shows the number of samples collected each year and the percent of those samples where no PCBs were detected. For 2012, 2014 and 2015, there were no samples that detected PCBs and in 2013 only 2 of 9 were able to detect any contamination. All measurements were well below the 500 ppt MCL for drinking water, but could not be assessed against the 0.17 ppt standard due to the minimum detection limit for the tests.

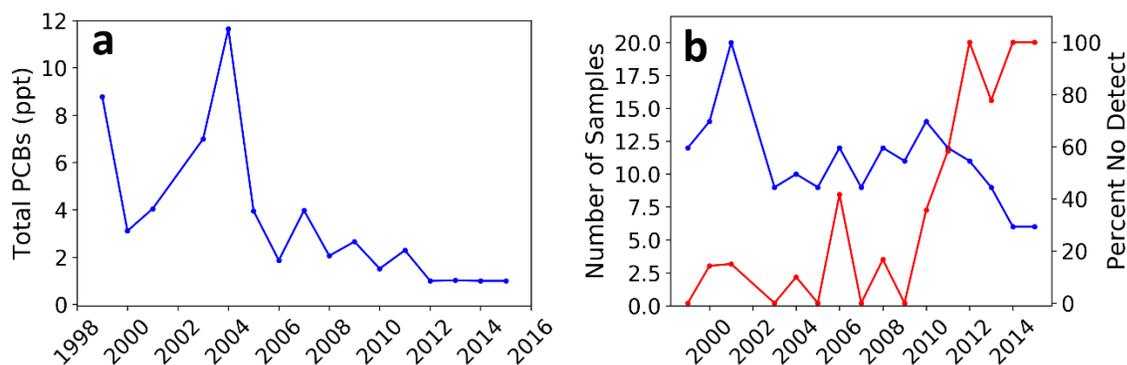


Figure 4: (a) Mean annual PCB contamination in Kalamazoo Lake surface waters; (b) number of samples collected per year (blue) and the percent of samples each year in which no PCBs were detected (red).

In summary, PCB concentrations in the sediments and surface waters of the Kalamazoo Lake region have greatly improved over the last 20 years. None of the sampling stations visited in 2019 had concentrations exceeding regulatory limits in the top six inches where they are most likely to be re-suspended into the water, and only five had elevated concentrations anywhere in the sampled profile. Where the 2019 sediment samples did contain elevated PCB concentrations, they had been shifted deeper since the 2000 sampling effort, reducing the likelihood of human exposure. The surface water PCB concentrations have also been steadily declining since 1999. Considerable progress has been made toward the goal of zero PCBs, with 94% of measurements from the last four years of sampling (2012-2015) detecting no contamination.