



## **CLEAN-FLO INTERNATIONAL**

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### **Lake Harmony Biobase Scan October 2022**

**Prepared for:  
Lake Harmony Watershed Preservation Group  
PO Box 791  
Lake Harmony, PA 18624**

#### **Sonar Scan and Mapping**

In response to excessive muck accumulation and decreasing depth, the Lake Harmony Watershed Preservation Group contracted with Clean-Flo to design and install an oxygenation-inversion system and to do routine maintenance and biological product applications. The Clean-Flo restoration program was designed to oxygenate and mix the entire lake, to accelerate organic muck decomposition, and to increase the lake's depth and volume. The system was installed and the application program began in 2018.

To design the system, a preliminary scan was made on September 13, 2017. This scan established the baseline conditions against which annual scans would be compared. Since the project started, annual or biannual scans have been performed to evaluate the progress of the restoration program. Annual scans have focused on improvements in depth and volume. The scan on which this report is based was done on October 20, 2022.

Scans are accomplished with a Lowrance fish finder/chart plotter with broadband sounder technology, built-in GPS antenna and high-definition mapping. The data collected consists of more than 30,000 discrete sonar points. The data obtained is uploaded to Biobase GIS, a cloud-based mapping service, to produce bathymetric maps of the lake and quantitative analyses of the depth and volume. Because of the loss of integrity of bottom composition data provided by Biobase, we do not include bottom composition in the 2022 assessment, nor will it be included in future assessments.

The current scan is the sixth progress scan since the system was installed. The results of this scan show that changes since 2021 have followed the trend since the projects start. Changes include:

- Increase in maximum depth
- Increase in average depth
- Increase in volume
- Inferred reduction of soft organic sediments

A summary of depth and volume increases, and corresponding sediment reduction, are shown in Table 1. There have been consistent improvements since the system was installed.

Between 2021 and 2022, the average depth increased from 8.12' to 8.24' (an increase of 0.12 ft), the maximum depth increased from 15.31' to 15.43' (an increase of 0.12 ft), and volume increased from 967.03 acre-feet to 980.92 acre-feet (an increase of 13.89 acre-feet, or 4.6 million gallons). The increase in volume is equivalent to the removal of 22,409 cubic yards – or 1,494 tri-axle dump truck loads – of sediment. This is a result of the decomposition of organic muck.

Taken together, since the system began operation and product applications began in 2018, there have been increases in average depth, maximum depth, and volume of 7.71%, 6.41%, and 7.77%, respectively. This is equivalent to the increase of the lake's volume by 319.7M gallons, and the effective removal of 102,414 cubic yards of sediment. These results demonstrate the effectiveness of Clean-Flo's bio-dredging concept and continuing achievement of the goals of this program.

**Table 1. 2017-2022 Depth and Volume Changes by Scan Date**

CATEGORY	9/13/2017	10/9/2018	4/4/2019	10/3/2019	4/6/2021	10/21/2021	10/20/2022	Total Change
Average Depth (ft)	7.7	7.9	8.0	8.1	8.1	8.1	8.24	+0.59
Maximum Depth (ft)	14.5	14.8	15.0	15.1	15.0	15.3	15.43	+0.93
Volume (acre-ft)	910.2	943.7	950.6	964.2	960.4	967.0	980.92	+70.70
Volume (Mgal)	296.6	307.5	309.7	314.2	312.9	315.1	319.7	+23.04
Muck Removed (cu. yd)	NA	53,982	11,148	21,893	(6,131)	10,761	22,409	102,414
Triaxle Truck Equivalents (loads)	NA	3,599	743	1,460	(409)	717	1,494	7,604

## Contour Maps

The contour maps from October 2021 and October 2022 are shown below (Figure 1 and Figure 2). The scale for each map goes from light blue (shallowest) to dark blue (deepest). Contours are in 1-foot intervals. The maps show a few different changes that have taken place. The 14- and 15-foot contours cover larger areas since the scan in 2021. The 11-foot contour has grown since 2021 with the most growth evident in the eastern basin. These changes are illustrated in zoomed-in maps in Figures 3 and 4. The changes shown in the maps below are consistent with the increases in average depth, maximum depth, and volume shown in the scan statistics.

Figure 5 illustrates contours from the original scan in 2017. Whereas in 2017 there was a very small 14-foot contour, this area has deepened such that the 14-foot contour is now far larger and there is now a significantly larger 15-foot contour in its place. By the same token, the 10-foot contour in the eastern arm of the lake has spread farther east and been replaced in its original area by much larger 11-foot contour.

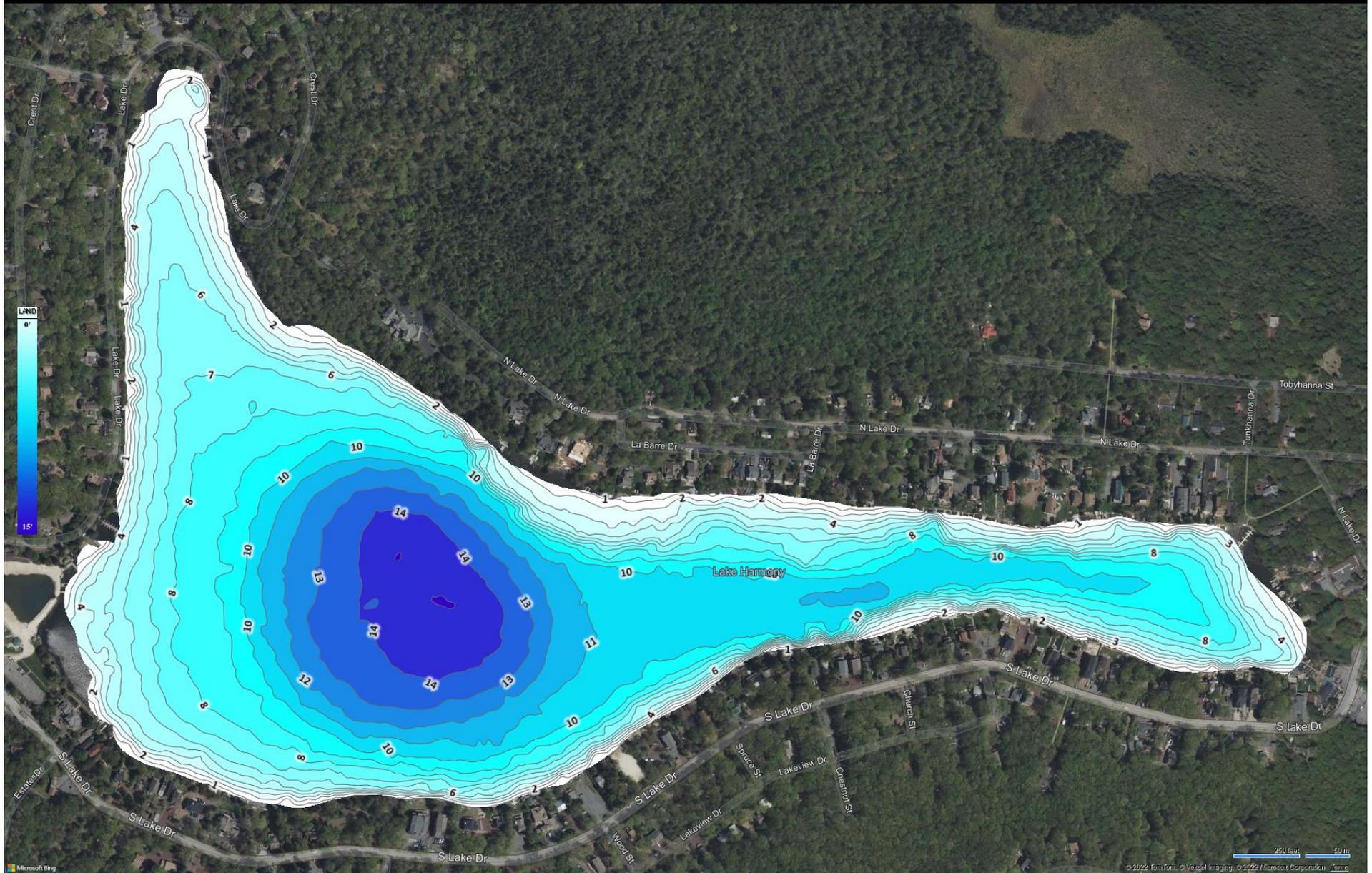


Figure 1: October 2021 Bottom Contour Map

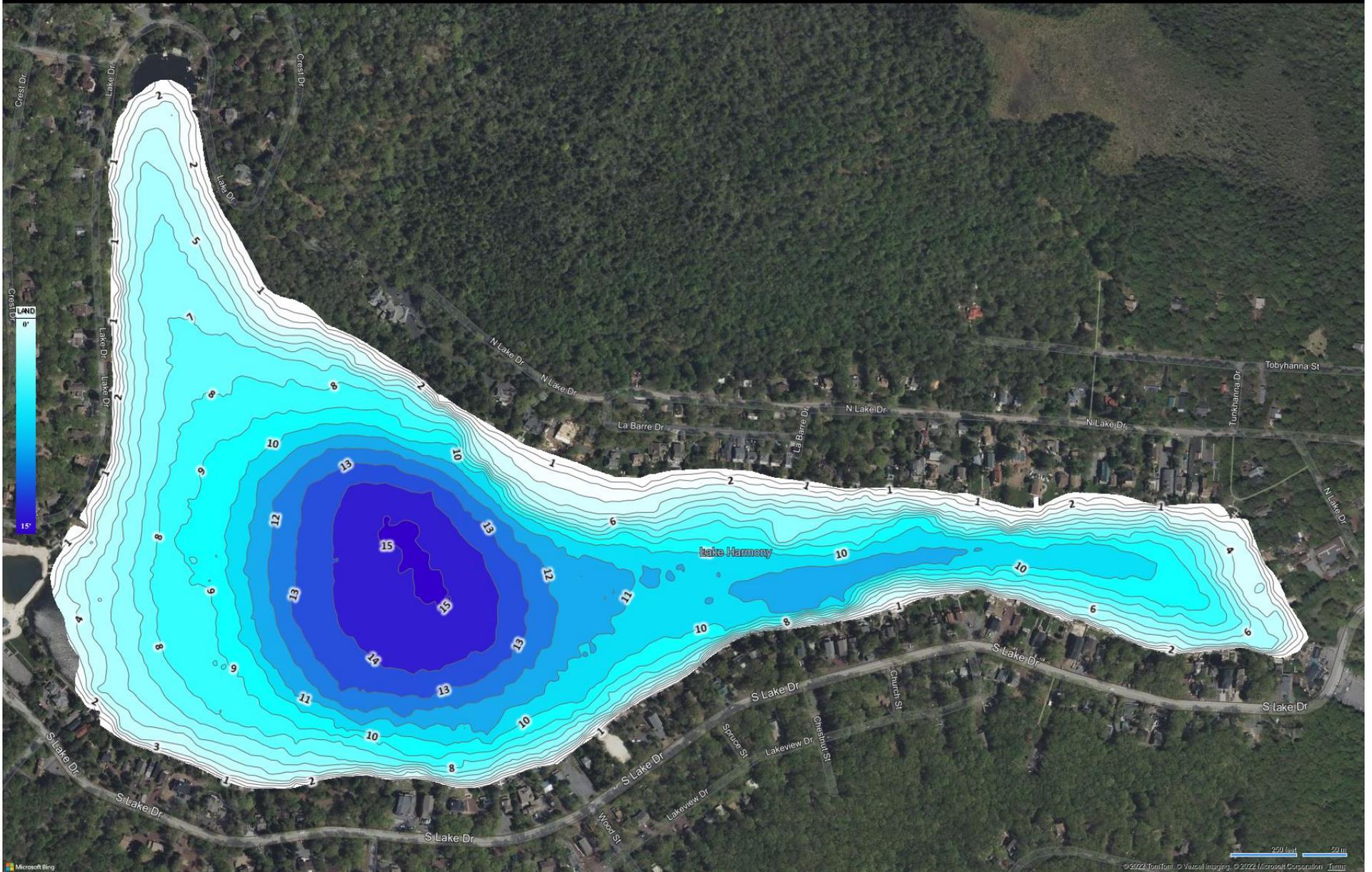


Figure 2: October 2022 Depth Contour Map

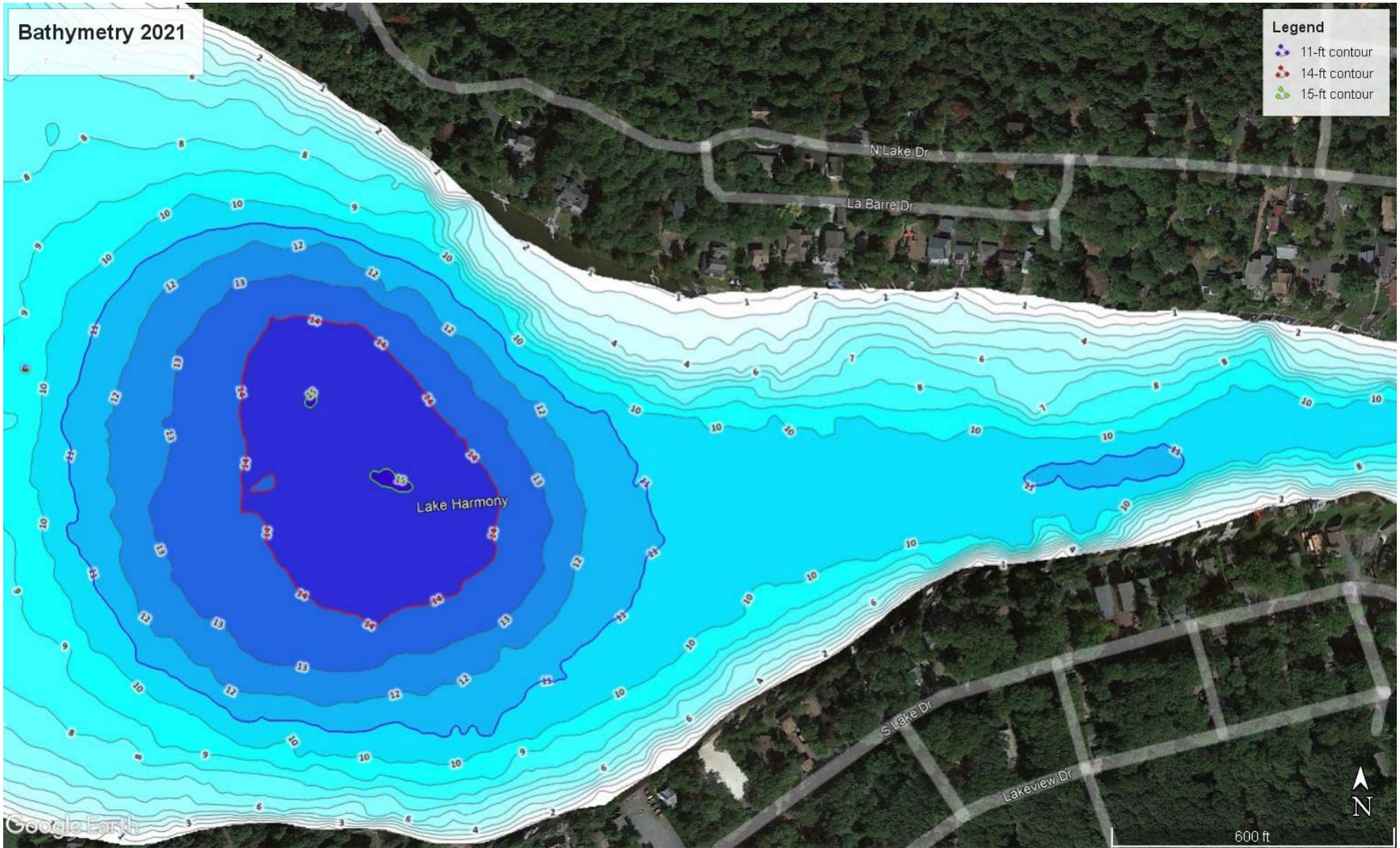


Figure 3. Map with contours 11, 14, and 15 isolated for comparison, 2021

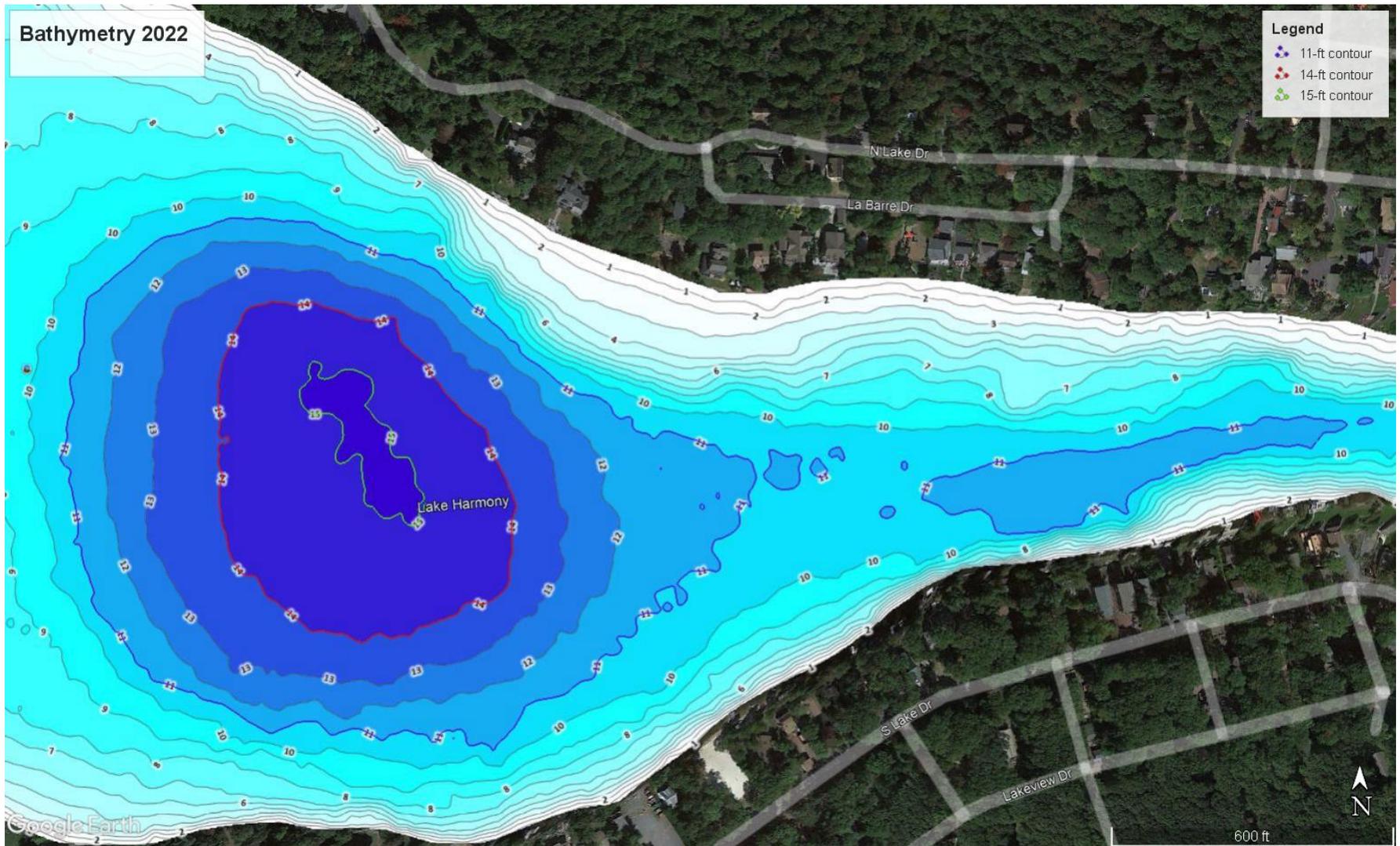
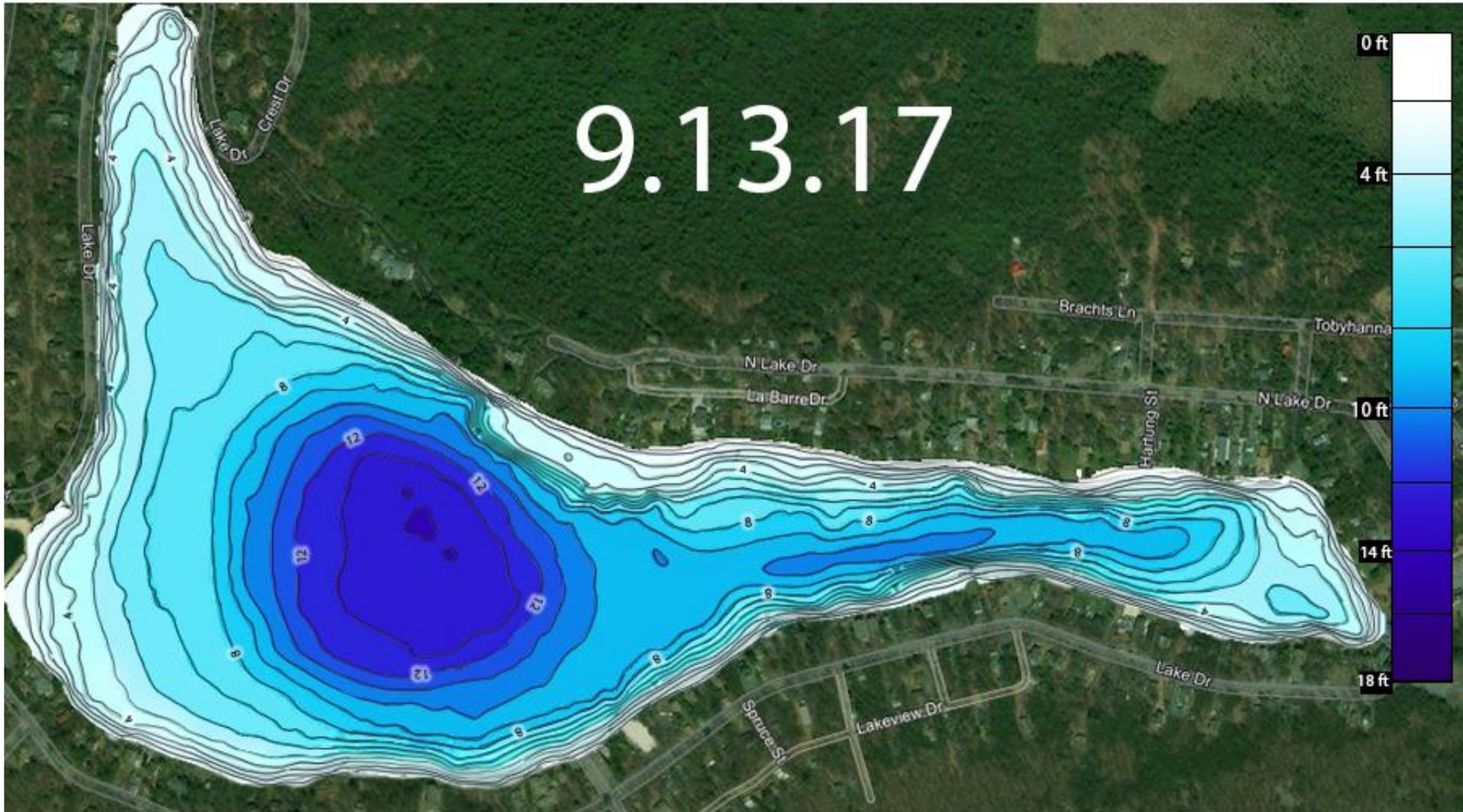


Figure 4. Map with contours 11, 14, and 15 isolated for comparison, 2022



**Figure 5. Contour 9/13/17** – The 2017 contour map is shown here. The deepest reading obtained in the lake was 14.14 feet. The 14' contour (14' or greater but less than 15') was small. The deepest contour in the eastern basin of the lake was 10'.

## **Summary**

Clean-Flo's oxygenation-inversion system and bioaugmentation program continue to achieve results in Lake Harmony. Between 2021 and 2022, the lake experienced:

- Increases in maximum depth, average depth, and volume of the lake
- Improvement in the fishery and general recreational use

The increases in depth and reduction of sediments are due to the decomposition of soft organic sediment and, by extension, show a continued hardening of the bottom. These improvements are due to the benefits of the oxygenation and mixing of the lake by the oxygenation-inversion system, and to the continued bioaugmentation program.

## **Recommendations**

Clean-Flo recommends that Lake Harmony continue to operate the oxygenation-inversion system and follow an annual bioaugmentation program of product applications. Continued applications are needed in the middle area of the lake due to the more extensive soft sediments in that area. As future progress scans are performed, the application strategy will be revisited from year-to-year to account for the response of the lake in certain regions and quantities applied.