

DEPARTMENT OF ENVIRONMENTAL CONSERVATION LEGISLATIVE REPORT

Report Name: Report on Funding of State Response to a Lake in Crisis

Year: 2022

Date reported: 1/7/2022

Authorizing statute: 10 V.S.A. 1314(b)

Committees: House Committee on Appropriations and Senate Committee on Appropriations

Prime contact: Lakes & Ponds Program – oliver.pierson@vermont.gov

Executive Summary

The Legislature of the State of Vermont created the Lake in Crisis Fund during the 2018 session and, using authorities granted under 10 V.S.A. § 1310, the Secretary of Natural Resources designated Lake Carmi as a “lake in crisis” in 2018. Lake Carmi is currently the only lake in Vermont with this designation, which was granted in response to intense and prolonged cyanobacteria blooms in 2017. Shortly after this designation and as per statutory requirements, the Department of Environmental Conservation (DEC), in collaboration with local stakeholders, developed the Lake Carmi Crisis Response Plan to identify projects aimed at improving water quality in Lake Carmi and the adjacent watershed, provide indicators to track implementation of these projects, and identify potential funding sources and partners for these projects. Implementation of the Crisis Response Plan has been ongoing since 2018, and the plan aims to both remediate the processes contributing to the impairment of the lake, namely eutrophication and related cyanobacteria blooms from excessive nonpoint source phosphorus loading and mitigate the sources of this nutrient loading to the lake.

To support targeted funding for clean water efforts in Lake Carmi and as per 10 V.S.A. § 1314, DEC has expended \$150,000 of lake in crisis funds appropriated to the Agency of Natural Resources from the Clean Water Fund in SFY2019, SFY2020, and SFY2021 and is in the process of expending an additional \$50,000 of similarly appropriated funds in SFY2022, also to support the implementation of the Crisis Response Plan. DEC is proposing the appropriation of an additional \$50,000 in SFY2023 to continue implementing the Crisis Response Plan and support the ongoing effort to improve water quality in the lake and reduce phosphorus loading from the watershed. The lakes in crisis funds covered in this memo are only a portion of a broader DEC-led effort to improve water quality at Lake Carmi, involving additional funds from the ANR Clean Water Initiative Program, the Agency of Agriculture, Food, and Markets Clean Water Fund Grants, and the Town of Franklin. Tables Two and Three below describes how the lake in crisis funds have been spent in SFY2019 to SFY 2021, and how these funds are being spent in SFY2022, respectively.

Key Takeaways

- Lake Carmi remains a lake in crisis, with persistent algal blooms and high phosphorus concentrations. Since the aeration system began to operate in June 2019, internal phosphorus loading has been reduced significantly, but in-lake total phosphorus concentrations are still above the targets defined in the 2009 Total Maximum Daily Load Phosphorus Reduction Plan.
- Through the end of SFY2021, state and federal investments in water quality projects are estimated to have achieved 41% of the required reduction under the Lake Carmi TMDL.
- Improved water quality at Lake Carmi may be achieved through in-lake phosphorus remediation efforts complemented by continued interventions in the watershed, and therefore continued funding and work is needed to achieve TMDL targets.
- A key goal for 2022 is to maintain the aeration system in operation for the entire growing season.

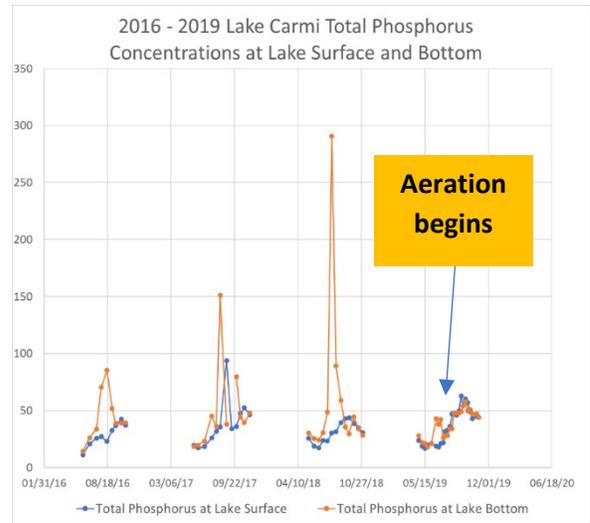


Figure 1: Lake Carmi phosphorus data shows reduced lake bottom concentrations from June 2019 due to the aeration system increasing oxygen at depth and preventing sediment phosphorus release.

Discussion

Lakes in Crisis funds appropriated from SFY 2019 to SFY 2021 have been spent on Lake Carmi water quality improvement and monitoring efforts, and DEC is in the process of spending SFY22 Lakes in Crisis funds on similar efforts (see table one below). An additional \$1.5 million of Clean Water Investments have been made in and around Lake Carmi since 2016 to reduce phosphorus pollution to the lake and improve water quality, primarily to cover the costs of installing the in-lake aeration system aimed at reducing release of phosphorus from lake bottom sediments; see the [Lake Carmi Clean Water Progress Report](#) for more info.

The aeration system reduced internal phosphorus loading in 2019, as shown in Figure 1 above. When the system is operational, it successfully mixes the lake and ensure that there is adequate oxygen at all lake depths. Figure 2 clearly shows that when the aeration system was working properly (for much of June and from mid-August 2020 onwards), the lake is mixed, and dissolved oxygen concentrations are uniform. Mixing the lake and ensuring that there is oxygen throughout the water column is an important step towards improving water quality in the lake, as the presence of oxygen in the water at the lake bottom prevents the release of “legacy phosphorus” buried in lake bottom sediments from being released into the water column to fuel the growth of plants or cyanobacteria.

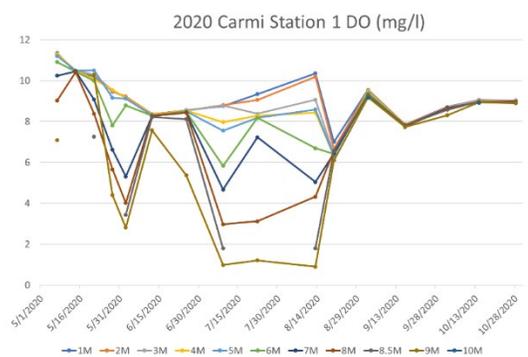


Figure 2: Dissolved Oxygen Concentrations in Lake Carmi

As previously mentioned, these and other investments have contributed to achieving around 41% of the TMDL phosphorus reduction target, and other water quality indicators in the lake, such as water clarity, have stabilized. However, it will take time before the watershed interventions improve water quality to the point where summer cyanobacteria blooms in Lake Carmi are significantly reduced, and therefore continued investment is necessary. Additionally, because certain water quality impairments found in Lake Carmi persisted throughout 2020 and 2021, additional work is needed before these impairments can be resolved and applicable water quality standards can be met, DEC is recommending that the House and Senate Committees on Appropriations appropriate an additional \$50,000 in funding to the Lake in Crisis Response Program Fund for SFY2023. These funds will be used to continue and/or enhance existing water quality improvement and monitoring efforts in Lake Carmi and its watershed.

Based on consultation with local stakeholders, DEC recommends using these funds in SFY23 as described in Table Three below. DEC will continue to support the implementation of projects aimed at improving water quality in Lake Carmi as well as monitor phosphorus levels in Lake Carmi and communicate the results of these efforts. With most elements of the Crisis Response Plan either underway or completed, including the in-lake aeration system as well as specific land management actions in the watershed, DEC led an effort with all stakeholders to update the Crisis Response Plan in 2020 to identify additional projects needed to achieve remaining TMDL goals and the updated plan is available on the [Lake Carmi Website](#). It is our expectation that we will see continued progress in the 2022 calendar year towards meeting phosphorus loading reduction targets as well as water quality standards in Lake Carmi and will continue to monitor and report on this progress.

Looking forward, the critical issue for SFY23 is maintaining the aeration system in full operation for the entire 2022 growing season (in previous years the system has been shut down temporarily due to technical failures) and then monitoring the impact of the fully operational system on lake water quality, from April through October, to determine to what extent the system can suppress internal phosphorus loading and contribute to reductions in the in-lake total phosphorus concentration. As these concentrations have increased in 2020 and 2021 to values well above the TMDL Target of 22 ug/L or parts per billion (see Table One below) due to a combination of factors, DEC and partners may also need to enhance our efforts in the watershed and the lake to ensure that we are making progress towards achieving this target.

Table One: In-Lake Total Phosphorus and Chlorophyll A Concentrations, as well as Secchi Depth readings in Lake Carmi from 2017 to 2021.

Year	TP (ug/L)	Chl A (ug/L)	Secchi (m)
2017	29.4	16.5	2.3
2018	29.1	14.2	2.4
2019	31.9	17.1	2.3
2020	35.1	45.1	1.2
2021	46.0	27.1	1.6