Analysis of Chloride Contamination in Cobbetts Pond In Relation to the Expansion of I-93.

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Background

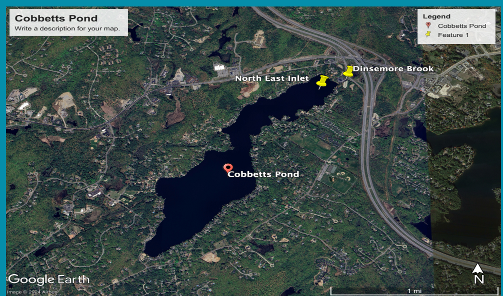

Figure 1 [10] shows a map of Cobbetts Pond made on Google Earth Pro with marked locations of sampling sites. The North East Inlet has been negatively affected by elevated chloride levels running off the highway and into Dinsemore Brook.

Located in Windham, New Hampshire, Cobbetts Pond is an area of recreation for residents. Past and present increases of cyanobacteria, *E. coli,* phosphorous, and turbidity have garnered interest in the pond's overall pollution levels [5]. This study analyzed the relationship between road salting, the expansion of major highways near Windham, and chloride ion concentrations within Cobbetts Pond.

Current Road Salting Practices

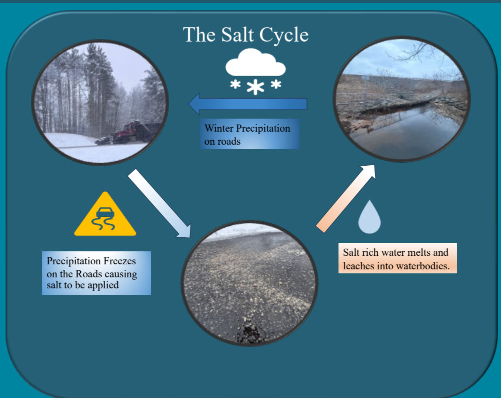

Figure 2 shows a simplified overview of the road salting process as well as an explanation of how salt gets into New England waterbodies.

Road salting in northern temperate climates has been known to have adverse effects on aquatic plant biomass [1], lake turnover [2], macroinvertebrate biomass [3], and zooplankton biomass [4]. Chloride ion concentrations, when coupled with rising temperatures , have also been known to influence cyanobacteria blooms within freshwater ecosystems [4]. These blooms are harmful to the health of human and biological life [8]. All of these events could cause negative outcomes for the ecosystem and recreational use of the Cobbetts Pond Watershed.

I-93 Expansion (2006-2021)

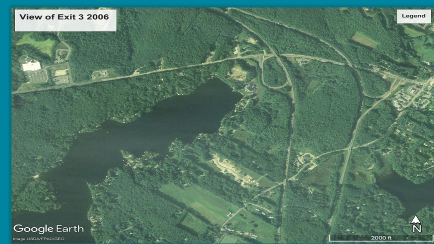

Figure 3[10] Shows a map of Cobbetts Pond and exit 3 in 2006 before the expansion of I-93 (seen in the righthand side of the frame). This figure also shows the development of houses around the pond in this year before the expansion of I-93

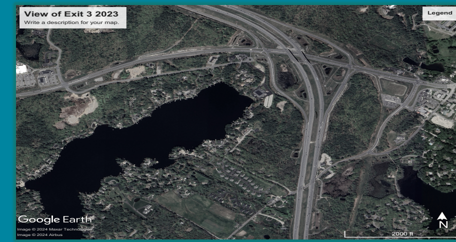

Figure 4 [10] Shows a map of Cobbetts pond and exit 3 in 2023 after the expansion of I-93. This map highlights the increase development compared to figure 2 as well as the overall expansion of the roads within the area since 2006.

Cobbetts Pond is of specific interest to the state due to its proximity to I-93 and Rt 111. These roads are areas of high traffic and require salting to maintain safe conditions for motorists during winter storm events. The 2006-2021 expansion of I-93, which widened the highway from 3 lanes to 4 lanes between Salem and Manchester, New Hampshire, allowed for greater density of traffic and infrastructure within the region[6]. Figure 3 and 4 show the increase in development that happened around Cobbetts Pond between 2006 and present day.

Chloride Levels of Cobbetts Pond

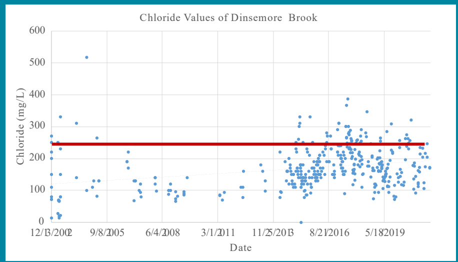

Figure 5 shows the chloride values of Dinsemore Brook which flows under both Rt 111 and I-93 that flows into Cobbetts Pond. This brook tended to have significantly higher chloride concentrations. The red line illustrates the 230mg/L limit established by NHDES that surface waters see negative effects.

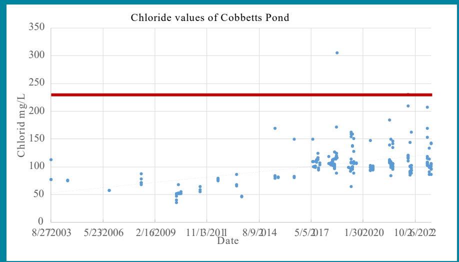

Figure 6 shows the overall trend of conductivity at all sample sites in Cobbetts pond. Overall, there is a rise in chloride concentration that occurred over the past 20 years. Equations from this are used The red line illustrates the 230mg/L limit established by NHDES that surface waters see negative effects.

The compiled data collected by the New Hampshire Department of Environmental Services (NHDES) illustrates that concentrations of chloride have climbed significantly in the last 20 years. Predictions made using the data trends show that of chloride ions could be above the damaging level of 230 mg/L, according to guidelines set by the NHDES, could be within the lake by 2044 [5]. It is possible that inputs of high chloride concentrations from Dinsemore Brook (Fig. 1) could have caused the higher than average levels of chloride ions in the northeast inlet. This suggests, but does not confirm, that I-93 is a major driver of chloride contamination within Cobbetts Pond.

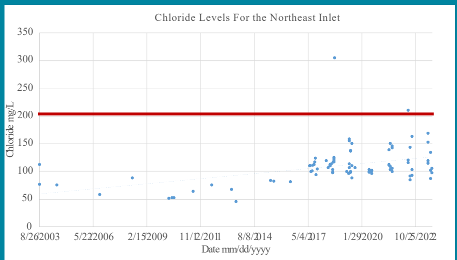

Figure 7 shows the trend of the chloride concentrations at the northeast inlet (figure 1). These values are a few units higher than the median values shown for all sites in Cobbetts Pond. This could point to this area being affected by the elevated concentrations of Dinsemore Brook which flows into this site. The red line illustrates the 230mg/L limit established by NHDES that surface waters see negative effects.

Location	10 year prediction	20 year predictions	30 Year predictions
Dinsemore Brook	232.9 mg/L	272.0 mg/L	311.1 mg/L
Northeast Inlet	161.7 mg/L	228.9 mg/L	262.5 mg/L
Cobbetts Pond	155.0 mg/L	223.7 mg/L	258.0 mg/L

Figure 8 shows predicted values for Cobbetts pond over the next 30 years. Values highlighted in red show values that are above the limit (230 mg/L for chloride levels according to NHDES [4]. Values in yellow show levels that are within 10mg/L of the recommended level. The red line illustrates the 230mg/L limit established by NHDES that surface waters see negative effects.

Possible Plans of Action

Figure 9 [10] shows a closer view detention basins installed on the side of I-93.

The detention ponds shown above were installed by the New Hampshire Department of Transportation (NHDOT) during the expansion of I-93 to manage storm runoff. Detention ponds are known to lower, but not eliminate, contamination by allowing pollutants from storm events to settle and be trapped at the bottom of the pond. Chloride concentrations still often exit these ponds between 50-150 mg/L [9].

Figure 10 (Fortin, 2024) shows 2 pictures that show snow blowing onto a road and a sidewalk after a melt.

Much of the mitigation of chloride contamination involves avoiding the addition of salt in the first place. Strategies for this could include using snow fences to prevent excess snow on the road or drainages to eliminate standing water and ice sheets. Both of these strategies are simple and cost-effective ways reduce the application of salt on to roads and sidewalks [7].

References

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