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## EXECUTIVE SUMMARY

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Jessie Lake, one of the larger lakes of Itasca County of northern Minnesota, has experienced severe episodes of poor water quality over the past 10 years exceeding levels that should be reasonably expected, given its size, depth, watershed size, and ecoregion. In 1998, a lake assessment study conducted by the Itasca County SWCD revealed an in-lake total phosphorus concentration of 57.3 ug/l, an increase of 135% with respect to a similar study completed in 1992 (24 ug/l). This increase placed Jessie Lake in the 90th percentile with respect to total phosphorus concentrations in the Northern Lakes and Forest Ecoregion. Severe algae blooms were frequent throughout the growing season, and consequently the lake suffered a decline in aesthetic and recreational value. It is evident that the water quality of Jessie Lake is unstable at best. These swings in phosphorus loading not only affect the lake seasonally (recreation and fishery potential), but are detrimental to the long-term “health” of the water body as well, and may be an indicator that Jessie Lake is approaching the point at which accelerated eutrophication could result from relatively minor increases in nutrient loading. Jessie Lake has been considered a premiere walleye fishery and destination for tourists and area residents, prior to these recent episodes. Changes in weather patterns, including increases in the amount of the ice free time as well as the length of growing season, have also been noted. Citizen and governmental agencies concerns over these highly valued waters resulted in obtaining a Clean Water Partnership diagnostic grant to study Jessie Lake in detail.

This Clean Water Partnership diagnostic effort relied upon state-of-the-art stream, lake water, and sediment investigations, working with the best diagnostic resources of the University of Minnesota including the Natural Resources Research Institute and the St. Anthony Falls Laboratory. The well defined results from the study show: (1) that this is an extremely sensitive lake from a nutrient-eutrophication perspective; (2) the lake has historically received a succession of cumulative impacts from logging, agricultural, and development; (3) the lake has significant and worsening internal phosphorus loading from its sediments; (4) the lake is polymictic from both a temperature and oxygen perspective leading to increased internal loading rates; and (5) the lake can be improved significantly over time, through reductions in external and internal phosphorus sources.

Lake management goals have been developed that will minimize watershed nutrient and sediment income to the lake. Present nutrient levels are relatively low, but improvable. Long-term lake restoration may require reduction of the primary P loading source – the lake’s sediments. Whole lake sediment treatments are the typical approach, however this approach would be cost-prohibitive. And, the internal loading appears to have been detected at a sufficiently early stage where incremental reductions will achieve longer-term stability (Hondzo et al, 2002). It has been proposed by the St. Anthony Falls Laboratory of the University of Minnesota that lake management goals can be achieved by incremental reduction of the organic P loading. For this purpose, it is proposed that the SAF Laboratory proceed to conduct bench testing of the use of locally available clays and taconite related materials for augmentation of the lake’s metal content (e.g. aluminum and iron) in the sediments. If further analysis concludes that Jessie Lake is at a point of accelerated eutrophication due to development impacts and no other feasible alternative is found, lake chemical treatments (e.g. alum) will likely be pursued.

Itasca County, as the primary local governing organization, has responded by further developing a county-wide lake sensitivity index to facilitate better management of high quality yet vulnerable lakes and streams. Given the climatic changes that are being experienced or likely to be experienced over the next few decades in Itasca County, it is likely that the shallower lakes like Jessie (e.g. polymictic and intermictic) will begin experiencing a greater recycling of phosphorus from the sediments similar to the southern lakes of the state. For this reason, it is in the best long-term interests of county, state, and federal governmental units to carefully assess viable management options and potentially new nutrient inactivation techniques for Jessie Lake to help set a course for future management of these sensitive water bodies. Lastly, given all of these factors, it is recommended that Jessie Lake be considered for long-term monitoring by county, state, and federal partners.