China Lake Watershed Study
Colby Environmental Assessment Team
Executive Summary

The Colby Environmental Assessment Team (CEAT) investigated the water quality of China Lake, located in China and Vassalboro Maine, from June through December 2005. The group analyzed physical, chemical, and biological water quality parameters from samples taken on China Lake and from tributaries flowing into the lake. An analysis of land use patterns, especially the impact of residential, commercial, municipal, and institutional development in this watershed, enabled CEAT to study their impact on water quality trends. Data collected by CEAT in 2005 were compared to historic data from the Maine Department of Environmental Protection (MDEP) to gain a historical perspective of lake water quality. The phosphorus model created from these data enabled CEAT to identify the sources of phosphorus that most threaten the current and future water quality of China Lake.

CEAT confirmed that the accumulation of phosphorus resulting from surface runoff, shoreline erosion, and internal nutrient loading negatively affects water quality of China Lake. Once the phosphorus concentration passes a threshold of 12 to 15 parts per billion (ppb), a lake may undergo algal blooms that decrease the aesthetic, recreational, ecological, and economic value of the lake and adjacent shoreline properties. Water quality improves with reductions of external phosphorus loading and sediment release of phosphorus caused by anoxic water conditions.

A brief summary of CEAT findings in the China Lake study:

- Using a water budget, CEAT calculated the flushing rate at 0.35 flushes per year. This value indicates that 35% of the water in China Lake is replaced each year, and all the water is theoretically replaced every 2.86 years. The relatively large size of China Lake and the relatively small watershed size contribute to the low flushing rate.
- The dissolved oxygen level in China Lake has decreased substantially since the first recorded algal bloom in 1983. No trends in dissolved oxygen concentrations exist in recent data, but concentrations in all recent years are lower than the levels historically found in the lake, particularly in deep water.
- Phosphorus concentrations over the summer of 2005 ranged from 11.4 to 199.3 ppb with a surface mean (± SE) of 22.5 ± 2.0 ppb and a hypolimnion mean of 55.7 ± 13.3 ppb. The high phosphorus concentration results in China Lake being classified as a eutrophic lake.
- Aerial photographs of the China Lake watershed from 1965 and 2003 were analyzed to determine changes in land use. One trend observed was an increase in development near the shoreline, including the rise of residential, municipal, and commercial lands.
- Buffer strips serve as the last boundary between surface runoff and the lake. A study of the 460 developed lots along China Lake indicated that 12% had buffer

strips rated unacceptable, 34% were rated poor, 40% were rated fair, and 11% were rated good. Buffer strips covering the entire shoreline distance of each lot with multiple layers of vegetation extending at least 75 feet from the lake are recommended on the China Lake shoreline where possible.

- Camp roads cover 18.0 hectares (44.5 acres) of the China Lake watershed and are estimated to contribute approximately 3.40 kg of phosphorus per hectare per year to the lake. State roads cover 58.5 ha (144.6 acres) and contribute less phosphorus, approximately 1.50 kg/ha/yr. Of the camp roads, 21% of the acreage covered was rated good, 43% fair, 26% poor, and 10% unacceptable.
- CEAT identified 40 problem areas during road surveys. These surveys identified problems such as the lack of culverts, crowns, or ditches as well as the presence of berms. Camp roads accounted for 39 of these problem sites, possibly due to the lack of state funded or mandated repairs.
- No invasive species have been found in China Lake, but the presence of large areas of shallow water and the three public boat launches make an infestation of Eurasian Water Milfoil, Variable-Leaf Milfoil, Hydrilla, or another invasive macrophyte species possible.

Successful water quality remediation begins with a reduction in the amount of nutrients entering China Lake. Maintaining roads, improving buffer strips, reducing shoreline erosion, and limiting development in areas with high erosion potential will help reduce the quantity of nutrients entering the lake. However, reducing external nutrient loading alone will not return China Lake to a clear water lake because of the advanced state of eutrophication and the significant phosphorus release from lake sediments during anoxic periods. Some form of in-lake mitigation needs to be taken. The most effective way to remove phosphorus-laden sediments would be to dredge the lake, but this alternative is both prohibitively expensive and ecologically destructive. Although expensive, the most cost effective solution is an alum treatment. Drawdowns are a less expensive, long-term, potential remediation technique but would be difficult with this large, two basin lake with a low flushing rate.