Poisonings of domestic animals and wildlife by blooms of toxic cyanobacteria (i.e., blue-green algae) are well-documented. Zoo animals may be particularly vulnerable to poisoning by water sources contaminated with cyanobacterial toxins given their forced close association with this resource. However, the potential threat of toxic cyanobacteria to animal health and reproduction in zoo moats is unknown. The objectives of this project were (1) to evaluate water quality (e.g., concentrations of nutrients (total nitrogen and phosphorus), algal biomass (chlorophyll a), and toxic cyanobacteria (the hepatotoxin, microcystin) in several moats at the Montgomery Zoo (Alabama) over the course of a year and (2) to determine if ecological interactions can be used to improve moat water quality. Our bi-weekly water quality survey revealed a huge range in total phosphorus (47- 1760 micrograms/liter), total nitrogen (446- 7630 micrograms/liter), chlorophyll a (9-465 micrograms/liter) and microcystin (0-15 micrograms per liter) concentrations across the moats with most concentrations being well above those observed in recreational waterbodies. Microcystin concentration was significantly correlated ($r^2=.32$, $p < .0001$) with algal abundance. The highest microcystin concentration observed was $15\times$ higher than threshold set by the World Health Organization for safe drinking water for humans. Using a field mesocosm experiment where we tested the effect of large-bodied zooplankton (Daphnia) on moat algal abundance, we confirmed that zooplankton herbivores could significantly decrease algal biomass by as much as 80% in replicated field mesocosms, relative to no Daphnia controls. Such control of algal biomass in zoo moats could have cascading effects on animal health, especially considering the high concentrations of algal toxins observed in some moats. Our future work will investigate the causes for such variability in moat water quality (e.g., differences in animal diets, precipitation, internal nutrient loading from sediments), and determine ecological solutions to minimize recurrent toxic cyanobacterial blooms in zoos and other freshwater ecosystems while minimizing their potential threat to animals.