

Development of a Water and Salt Balance Model for a Lake in the Southwestern United States



Lake levels and water quality have fluctuated over time



Historical lake water quality data were used to calibrate the Lake Model

EKI analyzed the water and salt balance of a 400-acre lake to assess (1) the water demand of the lake, assuming that supplemental water would be used to maintain the lake in a “full” condition, and (2) the future water quality of the lake, in terms of salt concentrations. To develop the lake water and salt balance models, EKI performed the following tasks:

- Compiled historical lake level and lake water quality information to understand lake functioning as a result of climatic variability, evaporation, and other factors such as groundwater levels and hydraulic properties in the local aquifer and the extent of emergent wetlands at the lake edge;
- Developed a conceptual site model of lake processes based on the understanding that natural inflows to the lake are precipitation, surface water inflows from intermittent drainages, and shallow groundwater inflows and that natural outflows from the lake include evaporation, evapotranspiration from the emergent wetlands, and seepage out of the lake;
- Compiled information regarding the amounts of supplemental water historically added to the lake on an annual basis; and
- Compiled information regarding the concentrations of total dissolved solids (TDS or salt) in each of the lake inflows and outflows.

Using the above information, EKI created a Lake Model, which consisted of a Water Balance Component and a Salt Balance Component. The Lake Model was calibrated against the available historical lake level information and TDS data for the past 6 years using the information described above as input data. The Lake Model was then projected forward to account for different lake management scenarios, future surface water inflows, variations in climate, and variations in the groundwater table resulting from the future climate and groundwater withdrawals, among other things. Outputs from the Lake Model included estimated future supplemental water requirements to maintain the lake at specified target elevations, the estimated future consumptive demand of the lake, and the estimated future TDS concentration of the lake.