Effluents from sewage treatment plants (STPs) are known to contain residual micro-contaminants including endocrine disrupting chemicals (EDCs) despite the utilization of various removal processes. Temperature alters the efficacy of removal processes; however, experimental measurements of EDC removal at various temperatures are limited. Extrapolation of EDC behavior over a wide temperature range is possible using available physicochemical property data followed by the correction of temperature dependency. A level II fugacity-based STP model was employed by inputting parameters obtained from the literature and estimated by the US EPA's Estimations Programs Interface (EPI) including EPI's BIOWIN for temperature-dependent biodegradation half-lives. EDC removals in a three-stage activated sludge system were modeled under various temperatures and hydraulic retention times (HRTs) for representative compounds of various properties. Sensitivity analysis indicates that temperature plays a significant role in the model outcomes. Increasing temperature considerably enhances the removal of β-estradiol, ethinyestradiol, bisphenol, phenol, and tetrachloroethylene, but not testosterone with the highest biodegradation rate. The shortcomings of BIOWIN were mitigated by the correction of highly temperature-dependent biodegradation rates using the Arrhenius equation. The model predicts well the effects of operating temperature and HRTs on the removal via volatilization, adsorption, and biodegradation. The model also reveals that an impractically long HRT is needed to achieve a high EDC removal. The STP model along with temperature corrections is able to provide some useful insight into the different patterns of STP performance, and useful operational considerations relevant to EDC removal at winter low temperatures.