

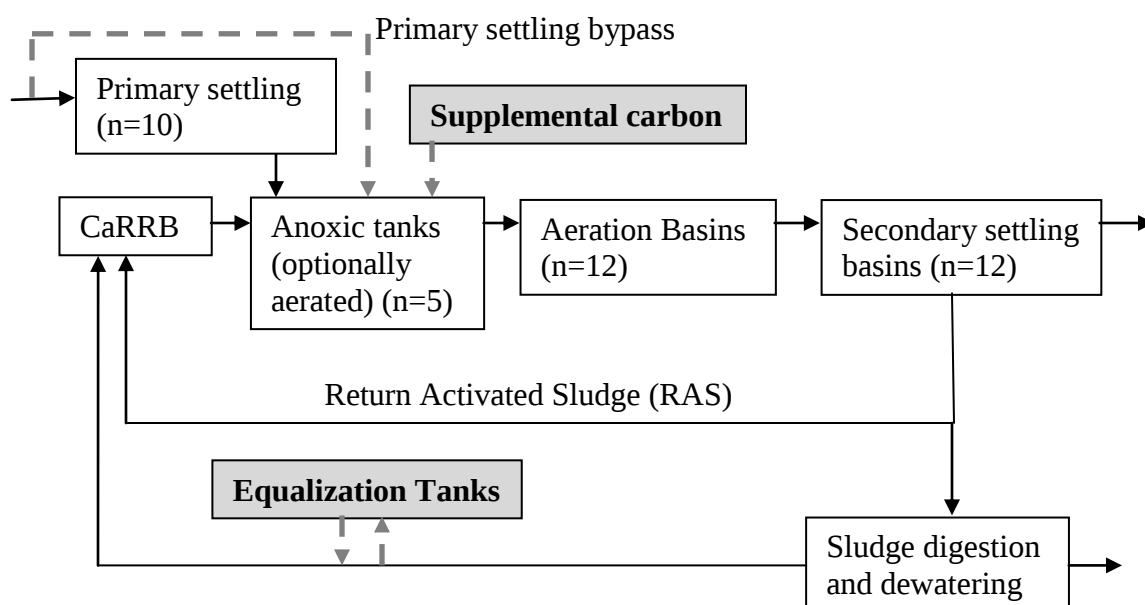
WASTEWATER TREATMENT MODELING PROJECT

The Metro Wastewater Reclamation District operates a split treatment secondary treatment system where the North Secondary (NSEC) provides nitrification and partial denitrification and the South Secondary (SSEC) provides BOD removal. The District operates the NSEC facility to meet monthly average ammonia discharge limits and a weekly average nitrate plus nitrite limit. The effluent from the North and South facilities is blended to meet discharge permit limits.

The NSEC receives approximately 60% of the influent total flow of 140 million gallons per day (MGD), as well as the liquid residual from the sludge dewatering process (centrate) and the return activated sludge (RAS). The NSEC liquid process line consists of a Centrates and Return activated sludge (RAS) Reaeration Basin (CaRRB), followed by activated sludge with five initial basins that can be operated in anoxic or oxic modes followed by 12 aeration basins operating in parallel. The centrate represents a large portion (average of 30 to 40 percent) of the ammonia load to the NSEC. Biological oxidation of ammonia produces significant nitrate and therefore the denitrification process is carbon limited under some operating conditions. In addition, centrate is produced intermittently whereas influent wastewater from Metro's large collection system follows a regular diurnal pattern.

Two activities are being considered to address the low COD:NO₃-N ratio and to avoid large spikes of ammonia from the centrate into the biological nitrification and denitrification processes. The District can provide supplemental carbon by either feeding acetic acid or by bypassing primary settling to feed higher strength wastewater directly to the activated sludge process. Also, centrate can be metered into the CaRRB step through equalization tanks.

NSEC Schematic (grey dashed lines are processes/operations being considered)



PROJECT SCOPE AND ACTIVITIES

Develop a simulation model of the wastewater and centrate treatment processes using BioWin and plant operating data. Calibrate your model with one data subset and verify with a second independent data subset.

Compare model output of effluent quality and to plant performance and to permit limits in steady-state conditions. Predict the variability of effluent quality throughout the day using 24-hour diurnal influent flow and water quality data and the over permit period using long-term flow and water quality trend data (to be provided). The effect of diurnal variation should be considered using a dynamic simulation method in BioWin. Long-term variability may be considered as a set of steady state simulations with a range of influent flow and water quality data selected to fit Metro data or using a dynamic simulation in BioWin. Identify the limiting element (process) of the treatment system with regard to capacity and effluent quality.

Develop operating scenarios to meet permit standards by varying process flows and conditions, and develop an optimum operational strategy which achieves permit values for BOD, suspended solids and all nitrogen species at minimal cost and considering benefits such as energy savings, biofuel production, and nutrient recovery. In this activity, also consider supplemental carbon addition and primary settler bypass for denitrification under steady state conditions as well as centrate flow equalization under 24-hour dynamic simulations using BioWin.

PROJECT DELIVERABLES

Submit a report of your modeling with a recommended operating strategy for the NSEC facilities to optimize performance, costs and benefits. Discuss your process for selecting the optimal operation and the major drivers that influenced your decisions.

Identify at least two variations of the operating strategy that could be implemented and under what conditions those variations would be advantageous (i.e. – increased wastewater loads, increased electrical costs, power failure, dewatering maintenance, extremely cold temperatures, etc).

What are the benefits and costs of providing supplemental carbon or bypassing raw wastewater. What would be the downstream impacts of the options? Which, if any, would you recommend to be implemented?

What would be the “limit of technology” effluent quality that you would assign to this system? Would the limit of technology capacity of the system be different than under the current permit limits?

DATA

Specifications for NSEC unit processes and wastewater quality data will be provided shortly.