## Summary

AECI Bioproducts (Bioproducts) is part of an industrial complex located at Umbogintwini, approximately 26 km south of Durban, Kwazulu-Natal. This system was selected for water pinch investigation, as it is one of the major users of freshwater on the complex and hence discharges a related quantity of wastewater, amounting to approximately 400 ML per annum. Bioproducts is a manufacturer of l-lysine, which is an animal feed additive.

Water stream flowrate and purity data, as well as operating cost information, were obtained from plant records at AECI Bioproducts. Limiting flowrate and purity conditions for the water-using operations were established from a mass balance over the entire system using the Linnhoff-March software, WaterTracker. Subject to the specified constraints and operating costs, the problem was to determine the design of the water-using subsystem. No treatment plants were included in the study, as none exist at the facility.

Three scenarios were investigated, which examined the operating variability of one of the evaporators on the site (the AS evaporator), which produces a condensate source of variable purity. The operating cost target and network design for each scenario was determined using the Linnhoff-March software, WaterPinch. Alterations from current operating practice were identified and associated savings (water-using network operating cost and freshwater flowrate) were highlighted.

A robust optimal design was identified, with a recycle, which was consistent for all scenarios investigated. The degree of reuse of the AS evaporator condensate source was determined to be dependent on the purity of the source. The limiting constraint was identified at the sea pipeline, for suspended solids (SS): a prohibitively low discharge concentration constraint was identified as posing the major obstacle for saving. The potential for saving was investigated by incrementing the SS concentration constraint and subsequently the free and saline ammonia (FSA) constraint and allowing for the broth effluent to be discharged via the sea pipeline (which was previously disallowed by an effluent exemption). Although relatively small savings were identified through process integration (from 0.61% to 1.56% of the water-using network operating cost), the analysis identified a potential saving of over 70% of the water-using network operating cost, with relaxation of the sea pipeline SS and FSA constraint.