

# MEMORANDUM

**To:** Saqib Shirazi, P.E., Innovative Water Technologies, Texas Water Development Board (TWDB)

**FROM:** Lianfa Song, Ph.D., Texas Tech

**SUBJECT:** Demonstration of High Recovery and Energy Efficient RO System for Small-Scale Brackish Water Desalination – August 2011

**DATE:** September 1, 2011

**CONTRACT:** 1004831107

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## **Recent Project Activities:**

During the current quarter, the following project activities were completed:

1. Results of our research were presented at the North American Membrane Society (NAMS) annual meeting in Las Vegas, Nevada in June 2011. Results were presented in an oral presentation and poster session.
2. The flow through the (vertical) holding tank was reversed to reduce the accumulation of salt and other impurities in the holding tank flushing. Now the concentrate drains out of the tank the bottom so that the accumulated salt and other impurities can be more easily removed out of the tank with concentrate. In order to test the effectiveness of this approach, experiments were repeated at all three salt concentrations (1,000, 2,000 and 5,000 mg/L) and for combinations of several feed flow rates and recirculation flow rates.
3. The energy consumption by the recirculation pump was assessed for the RO system. Experiments were conducted to determine energy consumption of the circulation pump for varies circulation flow rates and fluid dynamic calculation were conducted to determine the pressure drops in different segments of the RO system. Results of the experiments and calculations indicated that the pressure drop in the circuit and energy consumption level by the circulation pump of the RO system could be reasonably explained by the piping configuration used in the pilot RO system.
4. Phase 2 of the project on the effect of crossflow velocity on fouling mitigation is now on-going. As described in the project proposal, experiments are being conducted using two crossflow velocities, 0.1 meter per second and 0.2 meter per second. Synthetic feed water of various concentrations of silica colloids (Nissan

Chemicals) will be used the fouling mitigation experiments to simulate different fouling strengths in the feed water.

**Issues Encountered:**

1. Although modifications to the flow configuration for the holding tank indicate some improvement in the efficiency of flushing during discharge mode, 100% flushing of accumulated salt in the tank has not yet been achieved, as indicated by the higher than expected conductivity of the discharge stream at the end of the discharge process.

**Items to be Addressed and Anticipated Project Activities:**

1. The data for energy consumption in RO system under various operation conditions (salt concentration, permeate flow rate) will be analyzed and compared with energy consumption in the conventional RO system as reported in the literature.
2. More experiments on the impact of variable cross flow rate on fouling mitigation will be conducted. It is expected some preliminary results on the fouling mitigation will be reported in the next report.
3. A paper on the energy consumption in the RO system is under preparation. We plan to submit the paper to an appropriate scientific journal for publication before the end of this year.