

Effect of feed water characterization changes on brackish-water reverse osmosis plant operation: the town of Jupiter, Florida

Daniel Schroeder^a, Ashley Danley-Thomson^b, Thomas M. Missimer^{a,*}

^aU.A. Whitaker College of Engineering, Emergent Technologies Institute, Florida Gulf Coast University, 16301 Innovation Lane, Fort Myers, Florida 33913, USA, email: tmissimer@fgcu.edu (T.M. Missimer)

^bDepartment of Environmental and Civil Engineering, Florida Gulf Coast University, 10501 FGCU Blvd S, Fort Myers, Florida 33967, USA, email: athomson@fgcu.edu

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ABSTRACT

The feed water supply for brackish-water reverse osmosis (BWRO) water treatment facilities is commonly obtained from groundwater sources. During pumping, the production aquifer is generally recharged by the underlying aquifer at many facilities. Higher salinity water occurring below the production aquifer leaks upwards, which commonly causes the production aquifer salinity to increase over time. The pumping rate, wellfield design, the transmissivity of the aquifer, the leakance value of the confining unit, and the water quality in the underlying aquifer affect the rate of change in water quality. The Town of Jupiter Reverse Osmosis facility pumps feed water from the upper part of the Floridan Aquifer System. The permitted treatment capacity is 62,281 m³/d for the reverse osmosis design process, which requires about 77,851 m³/d of feed water. Consistent with the standard conceptual model of upwards recharge from the underlying aquifer when pumping, analysis of the water quality changes in the production wells indicate that the dissolved chloride concentration in most of the wells is increasing over time. Historically, the dissolved chloride concentration of the feed water has increased by an average of 314 mg/L (605 mg/L TDS) from 2014 to 2019. The average projected dissolved chloride value at the 20-y point is 1,268 mg/L (2,439 mg/L TDS) from 2019 to 2039. Analysis of the dissolved chloride concentration changes in the BWRO production wells indicates that the facility can continue to meet the potable supply water demand over the next 20 y. The BWRO plant was initially designed to treat raw water with a dissolved chloride concentration of up to 2,955 mg/L (5,683 mg/L of TDS). The town has plans to modify the plant process and equipment to allow treatment of feed water up to a concentration of 11,500 ppm TDS (5,980 mg/L of dissolved chloride), which should allow it to sustainably accommodate future water demand as salinity increases in the upper Floridan aquifer raw water supply. The Town of Jupiter BWRO facility provides an example of a successful facility design, operation, and continued planning to adjust for anticipated changes in the feed water quality of a BWRO facility.

Keywords: Brackish-water reverse osmosis desalination; Groundwater quality; Aquifer characteristics; Feed water quality salinity change; Town of Jupiter, Florida

* Corresponding author.