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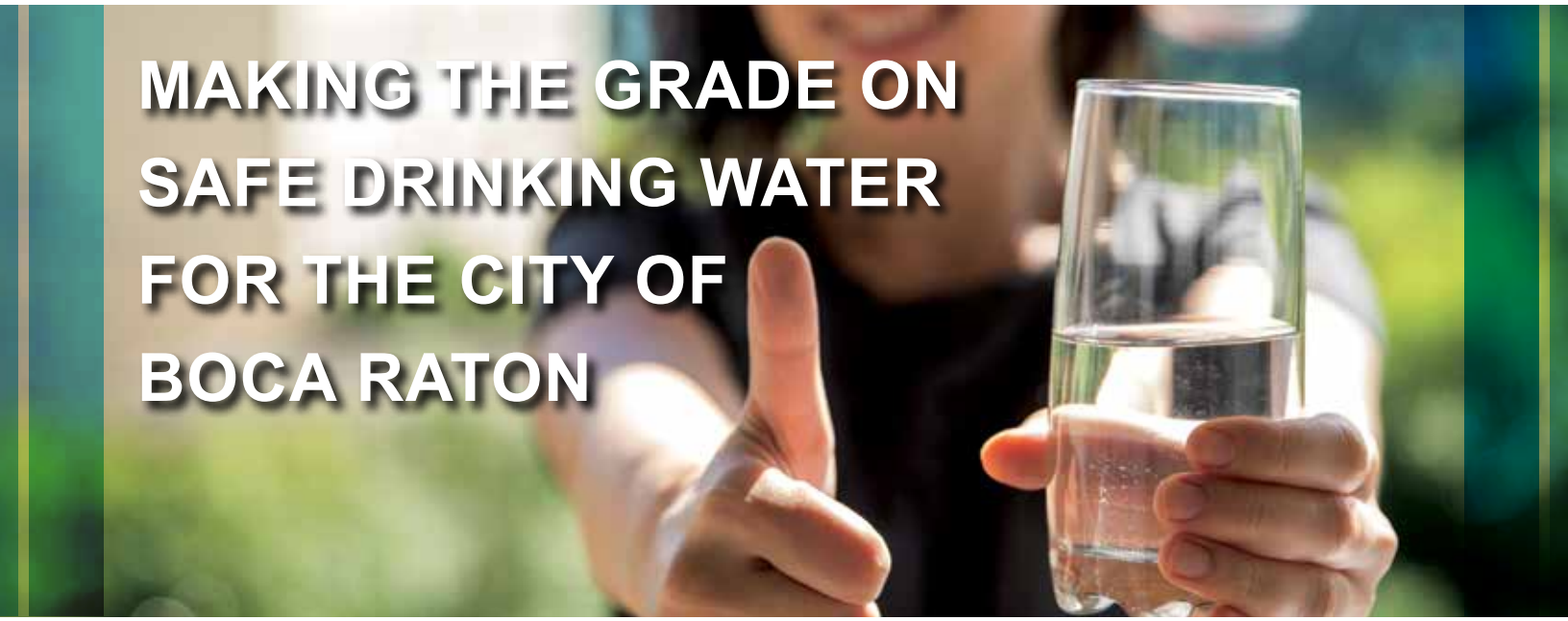


MAKING THE GRADE ON SAFE DRINKING WATER FOR THE CITY OF BOCA RATON

Case study

High Flow, High Permeate Quality and Cost Savings with high longevity (10 years) through ESNA1-LF2 membranes and low-fouling LD Technology®

The EXECUTIVE SUMMARY

The City of Boca Raton, FL, population 100,000, treats the Biscayne Aquifer wells containing high organics and color with Hydranautics ESNA1-LF2-LD. As more stringent DEP rules were put into place, the City commissioned their 40.0 MGD nanofiltration membrane plant in 2004.

This provided hardness softening and rejection of the disinfection by products (DBP's) associated with shallow well organics. The first set of membranes, the ESNA1-LF2 model, lasted 10 years. Following the change-out to the current version of that membrane, the new ESNA1-LF2-LD has provided the same permeate quality, DBP rejection, and has saved the utilities in energy consumption due to the LD Technology®. The plant now operates at 20% lower feed pressures, has better flux distribution to both 1st and 2nd stages, and has lower differential pressures. This new set of ESNA1-LF2-LD's have provided great performance.

The PROBLEM

The shallow Biscayne Aquifer is heavy in organics and color, precursors that potentially form DBP's. The City's water treatment plant was originally conventional lime softening, good at reducing hardness and alkalinity, but poor at reducing the high color units in the finished water. The plant would frequently receive home owner complaints about discoloration in their tap water. Commissioned in 2004, membrane softening via nanofiltration with Hydranautics ESNA1-LF2 membranes solved the issues of the color and DBP's, while passing enough alkalinity and hardness to keep the finished water relatively close to that of the old lime softening targets. This first generation of membranes saw flux declines and increasing differential pressures at a rate that made them clean each NF unit every 3 – 6 months. Although the ESNA1-LF2's were doing their job, the plant's staff was always busy with cleaning.

Location	Boca Raton, FL, USA
Feed water source	Biscayne wells
Application	Municipal drinking water
Capacity	40 MGD
Start-up date	2004
NF Design	72:36 array of 7M vessels, housing 756 membranes

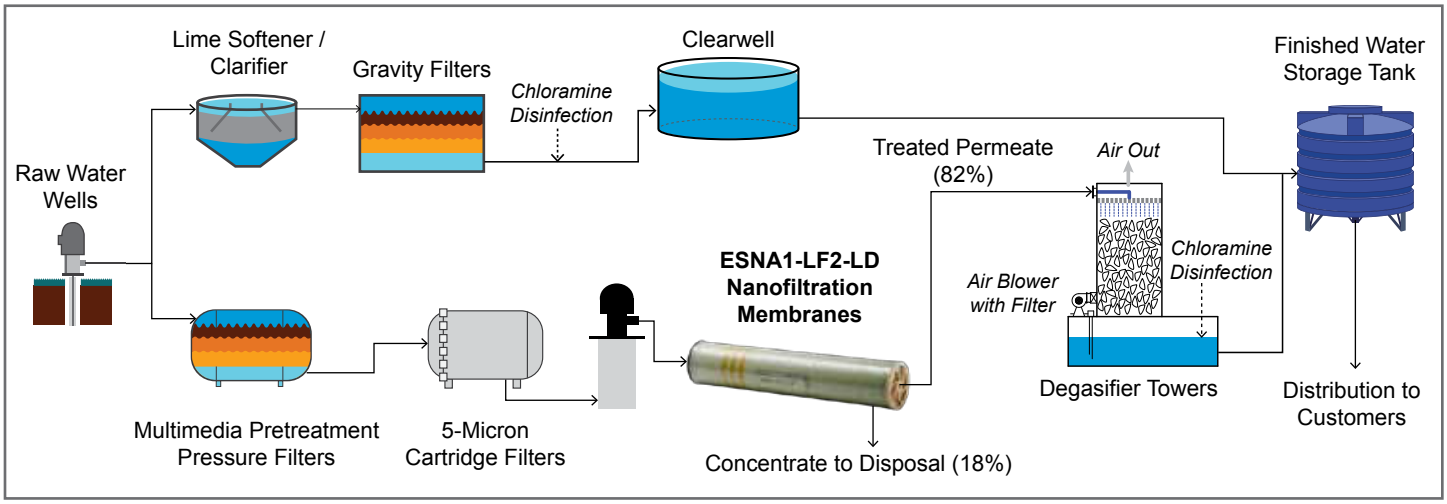
The SOLUTION

In 2015, the City changed out all the membranes and replaced them with Hydranautics new and improved ESNA1-LF2-LD which uses the larger 34 mil feed spacer, making for better distribution of flux within the spirals that resulted in lower differential pressures (dP) across each stage.

The flat sheet also provided less fouling potential as the need to clean due to flux decline and increased dP were minimized to 1–2 times each year instead of 3–4 times each year per NF unit.

Not only did this new set of membranes save on energy consumption, but the plant also saved on manpower and cleaning chemicals by not needing as many CIP's.

Each NF unit is a 72:36 array of 7M vessels, housing 756 membranes. The average flux per unit is 12.2 GFD and 82% recovery. There are 10 NF units at 3.676 MGD and 2 NF units at 1.838 MGD to make a total plant permeate capacity of 40.0 MGD.



The below table shows the performance of the Hydranautics membranes.

Constituent / Parameter	ESNA1-LF2 *(2004)*	ESNA1-LF2-LD *(replacements in 2015)*
Bicarbonate	< 175 mg/L as $CaCO_3$	< 175 mg/L as $CaCO_3$
Color	< 2.0 color units	< 2.0 color units
Total Dissolved Solids (TDS)	< 300 mg/L	< 300 mg/L
Total Hardness	50 - 80 mg/L as $CaCO_3$	60 - 90 mg/L as $CaCO_3$
Total Organic Carbon (TOC)	< 1.0 mg/L as C	< 1.0 mg/L as C
TTHM Formation Potential	< 0.042 mg/L	< 0.042 mg/L
HAA5 Formation Potential	< 0.030 mg/L	< 0.030 mg/L
Feed Pressure	95 - 100 psi	70 - 75 psi
dP 1st Stage	25 - 35 psi	18 psi
dP 2nd Stage	15 - 20 psi	12 psi

The IMPACT

The staff has seen the reduction in cleaning frequency, the lower fouling potential of this set of membranes, and the savings on energy, where currently after 2½ years of run time, the units are 20% lower in operating pressures than the previous set.

The City of Boca Raton has reaped the benefits of the newest ESNA1-LF2-LD in the way of stable performance that is producing the flows, permeate quality, and cost savings from lowered feed / differential pressures and the reduction of cleaning chemicals.

About the author

MR. KIRK LAI

***Kirk Lai** is the Field Service Engineer for Hydranautics and has been with the company for 14 years. He provides on site services and support to plants all across the United States.*

For more information about Hydranautics case studies, contact us at **hy-info@nitto.com** or visit our website at **membranes.com**

About Hydranautics

Since our founding in 1963, Hydranautics has been committed to the highest standards of technology research, product excellence and customer fulfillment. Hydranautics entered the Reverse Osmosis (RO) water treatment field in 1970 and is one of the most respected and experienced firms in the membrane separations industry. We joined the Osaka, Japan based Nitto Denko corporation in 1987 which was founded in 1918 and now has 117 companies in more than 20 countries, with over 30,000 employees worldwide. Our alliance with this global film industry giant boosts Hydranautics to a superior level of technological sophistication, product performance and customer response.

We are not simply product manufacturers; we are your membrane technology partners. As leaders of high quality membrane solutions, we believe our obligations extend beyond manufacturing and selling our products. Our skilled staff of technicians, engineers and service professionals assist in designing, operating and maintaining a robust, reliable and efficient membrane system to meet your requirements and exceed your expectations. Our support is offered from early stage conceptual design and engineering to start-up and maintenance, no matter the location globally whether it is on land or off-shore.

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