



**HYBRID MEMBRANE
TECHNOLOGY FOR
GROUNDWATER TREATMENT**

Case study

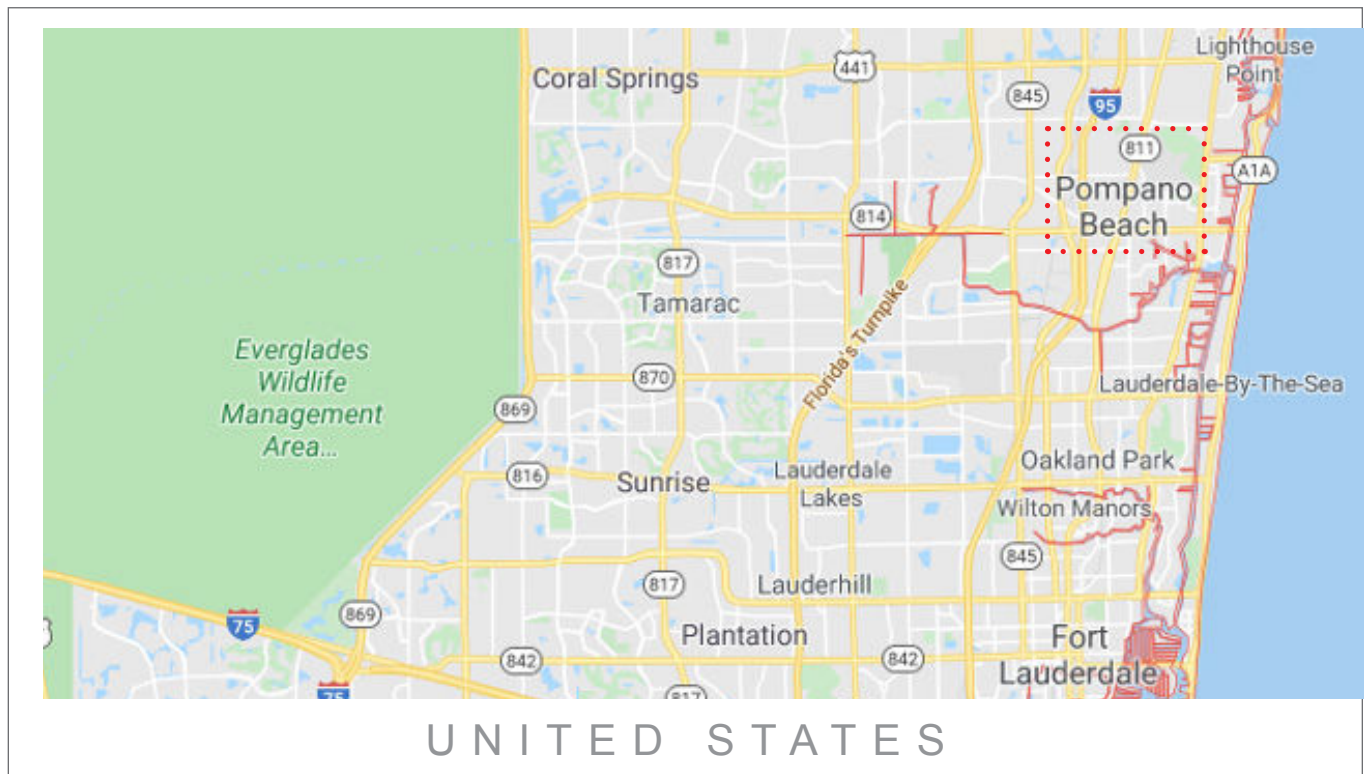
Treating low TDS brackish groundwater in water treatment plant at the City of Pompano Beach, Florida

The

PROBLEM

The City of Pompano Beach water treatment plant treats the shallow aquifer, low TDS, high organic content, moderate dissolved iron wells that blend both membrane permeate and lime softening products. The lime softening alone is ineffective at rejecting iron, TOC's, and disinfection by products. There have been two generations of NF membranes since commissioning in 2003 and the City wanted to

take advantage of newer technology that would reduce energy and require less pretreatment chemicals. They constructed a 2:1 array pilot unit with 8" vessels to mimic their full-scale plant to test two membrane types. The goal was to provide a permeate with > 25 ppm of total hardness and < 0.20 ppm iron at the lowest feed pressures while eliminating the use of sulfuric acid and scale inhibitor pretreatment.



The

SOLUTION

Hydranautics offered technical support for the installation and startup of the plant. After starting the first NF unit, the low permeate hardness required increasing the looser ESPA4-LD and decreasing the tighter ESNA1-LF2-LD. But restructuring the hybrid design meant there would be an incorrect number of ESPA4-LD and ESNA1-LF2-LD inventory on site. The installation was immediately stopped, and vessel testing started. Using the already running NF unit 3, Hydranautics unloaded and reloaded numerous first stage vessels to test different combinations of ESPA4-LD and ESNA1-LF2-LD membranes. Samples were collected and analyzed for total hardness and dissolved Fe to then determine the optimal hybrid combination of three ESPA4-LD and

four ESNA1-LF2-LD. All seven positions in the second stage used ESNA1-LF2-LD. Using the titrations for both 1st and 2nd stage permeate values and the start up flows, the combined permeate was found to meet the minimum of 25 ppm total hardness and the iron was in the range of 0.11 - 0.13 ppm, well below the max limit of 0.20 ppm Fe.

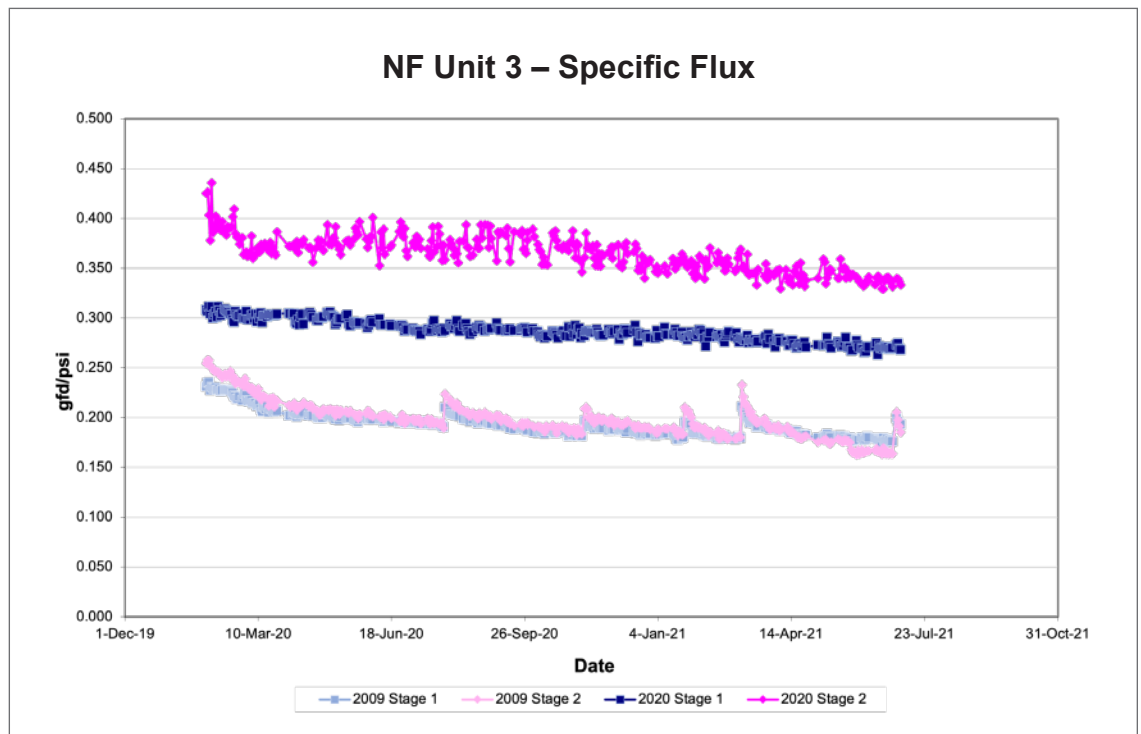
The new hybrid combination in 1st stage used three ESPA4-LD followed by four ESNA1-LF2-LD. The second stage used all ESNA1-LF2. This combination allowed Hydranautics to meet the minimum of 25 ppm total hardness and stay well below 0.20 ppm Fe. The system also stayed well below the specified trans membrane pressure limit of 73 psi.

With three of the five NF units loaded and not meeting permeate quality specifications, Hydranautics modified the original hybrid combination and installed more hardness passing ESNA1-LF2-LD membranes while removing the higher rejecting ESPA4-LD membranes. These three units were partially unloaded. The membranes were then placed on sheets of plywood and covered with plastic to keep them clean as they sat on the process room floor. Back at the factory, Hydranautics manufactured more LF2 membranes with lower rejection and higher flows and shipped them to the site. Hydranautics technical support teams analyzed three partial units of open membranes to identify, organize, and arrange them into new positions within the necessary vessels. Every extracted membrane was re-loaded. Not one was scrapped or wasted. When all five NF units were loaded with the new hybrid design using 3:4 ESPA4-LD to ESNA1-LF2-LD in first stage and all ESNA1-LF2-LD in second stage, the plant was able to achieve the target of 25 ppm total hardness and < 0.20 ppm Fe.

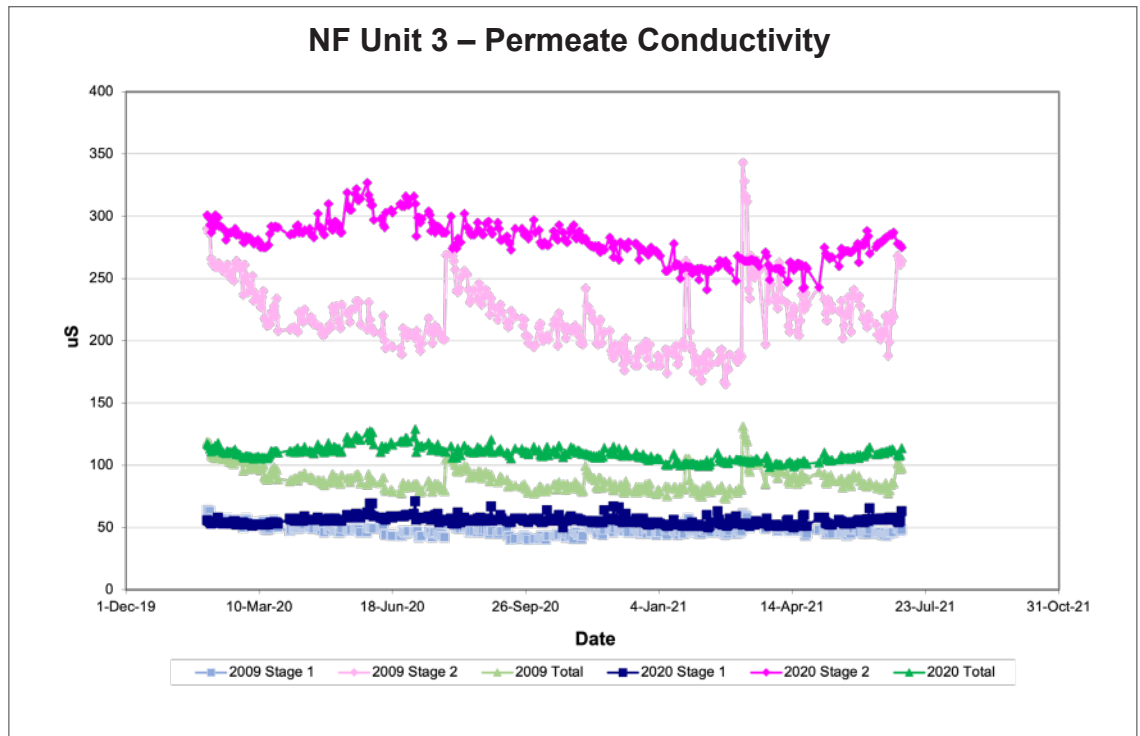
The contract called for a seven-day Performance Acceptance Test (PAT) running without pretreatment acid or scale inhibitor. We found that the Biscayne Aquifer feed for the pilot test took 3 to 6 months for stabilization to take place. Our team was able to use this pilot unit data and past plant startup experiences in South Florida, to show the engineers and designers that the ESNA1-LF2-LD, in these five NF units treating Biscayne Aquifer wells, will increase in total hardness over the long term to meet > 25 ppm and still achieve < 0.20 ppm Fe.

Hydranautics was able to meet customer expectations by:

- Identifying the problem - low hardness passage
- Testing numerous hybrid combinations at site
- Modifying inventory with manufacturing and delivery
- Putting the new hybrid design into action
- Successfully meeting specifications, completing the membrane changeout project.



NF Unit 3 – Permeate Conductivity



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For more information about Hydranautics case studies, contact us at hy-marketing@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 now one of the global leaders in Integrated Membrane Solutions. Hydranautics became a part of the Nitto Group in 1987. Nitto is Japan's leading diversified materials manufacturer. The group offers over 13,000 high value specialty products worldwide including optical films for liquid crystal displays, automotive materials, reverse osmosis membranes for desalination and transversal drug delivery patches.

As leaders of high quality membrane solutions, we believe our commitments 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.