Water Desalination Report

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Florida

Hurricane-proof SWRO nears completion

In January 1981, a new 3 MGD 11,355 m^3/d) SWRO plant was commissioned on Stock Island, Florida, to serve the Lower Keys. Feedwater was supplied from seawater wells and was billed as the 'world's largest single-pass SWRO plant'. The new plant was operated continuously until the construction of a new pipeline from the mainland was completed in late 1982.

For the six years following the pipeline's completion, the plant remained in standby mode, with trains operating for two hours per week, every other week, and flushed with fresh water. Then, in July 1988, the plant was mothballed, and the Florida Keys Aqueduct Authority (FKAA) developed a plan to bring it back online within 48 hours following a hurricane or another catastrophic event.

The plant was refurbished following hurricane Andrew in August 1992, when a feasibility study concluded that the diesel-powered SWRO was a feasible solution. It was also decided to relocate two of the six SWRO trains to Marathon Island to supply emergency water to the Middle Keys. A second major rehabilitation was completed by Harn R/O in late 1999, and the Stock Island plant was also renamed the Kermit H. Lewin RO Facility.

In 2021, the FKAA received a loan under the US EPA's Water Infrastructure Finance and Innovation Act (WIFIA), to support infrastructure upgrades necessary to ensure resilience to extreme weather events and climate change under the Florida Keys Imperiled Water Supply Rehabilitation Project. The $48 million project includes replacing and expanding the existing SWRO plant and supporting upgrades to aging infrastructure, including 12 miles (7.5km) of aging pipes and an underperforming water distribution pump station.

Florida's Department of Economic Opportunity is providing a Community Development Block Grant- Disaster Recovery in the amount of $30.7 million, and the remainder will be funded by FKAA.

The Kermit H. Lewin RO Facility has now been replaced with a new and larger, 4 MGD (15,140 m^3/d) SWRO facility that is capable of withstanding a Category 5 hurricane, and must remain fully operational during 25-year flood events and wave action. The plant is located in a single, 16,400 ft^2 (1,524m^2) concrete building with occupied floors located 20 feet (6m) above the base flood elevation. All of the water treatment equipment, except for the pretreatment equipment, will be located on the elevated first floor.

FKAA's Hurricane-proof SWRO crib

Each train is equipped with two, 300 HP Danfoss APP86 pumps and three, 30 HP iSave 70 energy recovery devices with a specific energy consumption of 8.6 kWh/kgal (2.27 kWh/m^3). According to Carollo, who served as the project engineer, smaller pumps were easier to lift and install, and use of multiple small feed pumps for each train reduced the cost of having a spare pump on the shelf for reliability.

Carollo's Abhisek Manikonda noted that the RO technology and equipment installed on the project has been standardized to decrease vulnerability resulting from availability and pricing, and that the new plant, despite having twice the production capacity, has an energy consumption that is 33% lower than the smaller plant.

The existing wellfield will provide feedwater, and concentrate will be discharged to the existing disposal well. A separately funded generator building, with four, 1,000 to1,500 kW diesel generators and four, 10,000-gallon (38m^3) storage tanks, will be a component of the overall project.

Biwater Inc furnished the project's RO system, which was designed to operate at up to 1200 psi (82.7 bar), with super duplex 2507 high-pressure piping and valves, while the

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FRP membrane supports being fabricated in Biwater's shop

membrane support frames were fabricated from specialty coated fiberglass at the company's California factory. Richard White, the company's president, predicts that the system will hold up to the harsh coastal environment, adding, "This has been an excellent project for us, and we're looking forward to starting it up in the next few months."

Lessons Learned
MY FAVORITE PROJECT

GWI's DesalData currently contains 22,875 project entries around the world, using a variety of thermal and membrane processes: seawater projects, brackish water projects, reuse projects, and ultrapure water projects. Behind each of those projects there are stories. Stories about the project's development, sale, construction, commissioning and operation.

In 2020, *WDR* asked veteran desalters to write *their* brief stories about their favorite, or most memorable projects. Some told about projects they lost, while others wrote about projects they won, and some wanted to write about multiple favorites. Twenty-four desalters responded, and their stories were included in issues over the next few months.

Last month, another call was put out, this time to desalters who were active in the industry prior to 2000. The replies have been trickling in, and like before, the responses have been varied. Some wrote about early projects, and others about a recently commissioned project; a few even wrote about the same plant. Some of the projects were so memorable that their authors (greatly) exceeded the specified word count.

As space allows, *WDR* will run two or three 'favorite project' stories per week for the next few weeks. Here are this week's installments:

Rodney Clemente, Energy Recovery, Inc
Dhekelia SWRO, Cyprus

Energy Recovery has over 35,000 PX® energy recovery devices (ERDs) deployed in over 175 mega-projects, but there is one project that is still near and dear to my heart: the Dhekelia Desalination Plant in Limassol, Cyprus, which was built, owned, and operated by Caramondani Desalination Plants Ltd.

The plant began operation in April 1997 with a capacity of 20,000 m^3/d and was soon expanded to 40,000 m^3/d. At that time, the plant was equipped with eight Francis turbine ERDs and DuPont B-10 permeators operating at an 80-bar feed pressure. This was at a time when Energy Recovery, Inc was still working to establish large-scale references, and the industry sentiments were still that "PX will only work in small plants."

After being introduced to Energy Recovery, and piloting the technology for an entire year at Dhekelia, the plant manager, Mrs. Olga Sallangos, made the courageous and visionary move to retrofit a few trains with our PX 120 dual rotor technology.

Caramondani's Dhekelia, Cyprus, SWRO Plant

While it wasn't perfect, we knew that, if successful, the adoption of PXs would happen at a more rapid pace. I remember being in the 'trenches' with Dr Rick Stover, Juan Miguel Pinto, and Bill Anderson, continually improving and innovating various ceramic designs. In 2007, the entire plant was retrofitted and again the plant production capacity was expanded, this time to 60,000 m^3/d.

As they say, "The rest is history!"

Epilogue: The Dhekelia Desalination Plant is still in operation and provides potable water for parts of Larnaca and the free Famagusta area at a contract price of €0.82/m^3 ($3.46/kgal). The plant's contract with Cyprus' Water Development Department is expected to expire in May 2027. Olga Sallangos is still the Dhekelia plant manager and the current president of the European Desalination Society (EDS).

Jon Dietrich, Dietrich Consulting Group

Carlsbad "Bud Lewis" Seawater Desal Plant, California

In 1999, while working for Montgomery Watson (now Stantec), we teamed with Ionics to bid for a seawater desalination project that was to be located at Florida Power's Anclote power plant in Tarpon Springs, Florida. However, the Poseidon Water/S&W Water team prevailed, and was selected to build the first large-scale SWRO plant in the US, for Tampa Bay Water, adjacent to the Big Bend Power plant. At the time, this was the largest SWRO in the Western Hemisphere.

After having been involved in many aspects of SWRO projects dating back to Diablo Canyon, California, and the Point Lisas Trinidad SWRO pilot project, I decided to try my best to find a way to get involved in the Tampa Bay Desal Plant project.

I was living in Tampa at the time and, with my experience, thought that I had a good chance. Through a friend-of-a-friend, I was able to get an interview with the Poseidon/S&W team, and in May 2000, was hired with the lofty title of Director of Technical Services. At a small development company, this meant I wore five different technical hats and spent many very late nights in the office. Wow.

This was about the same time that Poseidon began to operate a pilot plant in conjunction with their plans to develop the Carlsbad Desalination Plant, and Peter MacLaggan asked me to come to the West Coast to help with the project that would become my favorite, and most memorable, desalination plant.

In the ensuing 24 years, the Carlsbad "Bud Lewis" Seawater Desalination Plant and I have had a very long and sometimes complicated relationship, starting with my operation of its pilot plant in the formerly empty Encina Power Station parking lot, and most recently, to commission the permanent, new, 1-mm screened intake system.

Although I started my own independent desalination consulting firm in 2005, I retained Poseidon Resources (now Channelside Water Resources), the owner of the Carlsbad plant, as a client, and have continued to work with them on facility utilization, optimization, and special projects ever since. The Carlsbad plant is special for what it represents in the United States, and working with an incredibly dedicated and focused group of people who made the plant happen (and continue to do so) is a treasure and the professional experience of a lifetime.

All the projects that I have worked on are, in some way, special to me, and I remember them all. However, in my 36+ year career, Carlsbad—similar to my second most memorable project: the Tampa desal project—has provided me with experience dealing with bankers, investors, insurance agencies, hordes of engineering companies, experts, environmentalists, permitting agencies, contractors, operators, journalists, and weekly newsletter editors. Every facet of the industry – a true career's worth of exposure and experience wrapped up into one project, surrounded by highly dedicated professionals who all know that failure is not an option, and success can be achieved when we work together.

Epilogue: In November 2015, sixteen years after development began, the 50 MGD (189,250 m^3/d) SWRO project began commercial operation. The Carlsbad desal plant was co-located at the NRG Encina Power Plant, and its permit allowed it to use the power plant seawater intake and cooling water outfall. When the power plant was decommissioned in 2020, the desal plant's permit required it to make extensive changes to its intake and outfall to operate as a standalone facility, beginning with a fish-friendly brine dilution pump station. All of the changes are nearly complete, and as he mentioned, Dietrich will be involved in the final commissioning.

Matt Politzi, Turing

Fernando de Noronha island, Brazil

In October 2000, I was an engineer with TSG Water when we received an urgent call from Dr. Kepler, a university professor who was responsible for desalination in Brazil. As I recall, the government had purchased a 50,000 GPD (190 m^3/d) SWRO system from a company that shipped the system to the island of Fernando de Noronha, just south of the equator, and 350 km off Brazil's northeast coast. Unfortunately, the company went bankrupt before the system could be installed, and the client needed it to be operational as soon as possible.

The island was used as a military tracking station, and the job site was located in what is now Marine National Park, known for its beautiful beaches and the diverse marine life that swims in its warm, clear waters. I was just engaged to be married, and was able to negotiate an arrangement in which my fiancée would accompany me for a 30-day mission to install and commission the project.

Within two weeks, we were on a plane and off to experience the adventure of a lifetime. Dr Kepler met us on arrival, and took us to a repurposed WW2-era Quonset hut-turned-hotel. He also introduced me to the two Portuguese-speaking laborers and one skilled laborer/translator that would assist me.

We had 30 days to bring the system online. It was one trip with one directive: “Make water before you come home”. My only moral and technical support would be a weekly long-distance phone call to my friend and mentor, Dean Bedford.

The next day we arrived at the site and were faced with a pile of unusual brown-colored PVC piping, assorted valves, fittings and pressure gauges, a basic tool set and two hand saws. I was full of youthful enthusiasm, and although I had installed a couple of SWRO systems, I was no expert. I had watched Dean field assemble RO plants using a basic P&ID, and now it was my turn to do it alone.

The language barrier was my initial challenge, and most communication involved hand gestures. I started by laying out the equipment and visually mapping the pipe work to connect the four pressure filters. I made a few primitive sketches, and we started cutting and dry fitting the pipe for the face piping and valve trees, using hand saws and sandpaper. Paint brushes and rags were used to prep, clean, and glue together the plastic piping and valves. With limited supplies and components, we measured five times and cut once.

With a hard deadline and so many problems to solve, I was running on adrenaline and a bit of panic. Initially, I took short lunches and worked alone, while my co-workers followed the local custom of taking an extended, afternoon siesta. But, by the end of the second week, I too had adopted the traditional 3-hour lunch break, complete with nap.

We often watched a separate crew, that was constructing the RO building, climb trees to collect cashews and fruit during their siestas. They were resourceful, and would then build a fire and, in an old paint can, roast up the cashew nuts, which they lightly salted and generously shared with us. We were also introduced to the small fruit that comes with each nut. It was fantastic; not a word of English was spoken, and we all shared the worksite with great respect.

They were crazy days, with my fiancée spending time at the beach while I worked. But we always enjoyed our evenings together, eating, relaxing, and drinking caipirinhas—the national drink of Brazil, made with fermented sugarcane juice, rum, limes and sugar. One is great, two is good and three is simply wrong. We missed dinner on a few occasions when we sipped a few too many cocktails while waiting for our meals.

Feedwater was sourced from a seawater well, but the *bombear* feed pump produced insufficient head to deliver water up the hill and through the pre-filters. During my first weekly call with Dean, he helped me select a new pump for the application, which we sourced from a Brazilian supplier via airplane in a couple of days. Early in my career, I learned that planning is essential on an island, and the next best thing is to have a support crew capable of sourcing and coordinating overseas shipments. We had an ongoing bill of materials so we could have one more overseas shipment of bits and bobs to finish the job.

To our surprise, we were able to energize the skid using the three-phase power from the panel on the wall. After a bit of point-to-point testing, we were thrilled to find that the skid wiring checked. With no documentation or functional description, we carefully, and successfully, tested the PLC program. It checked out, and we were getting close to punching the big green GO button!

Membranes loaded, motor rotation checked, pumps primed, air purged, manual valves set and one final basic sequence test. We were exhausted. The following day would be our final day on the island, and we were scheduled on a late afternoon departure flight. Dr Keppler arrived that morning, and it was time to make the magic happen.

With the sample valves open, we energized the skid, said one last prayer to the water gods, and turned the hand/off/auto switch to run. The VSD slowly ran up the HP pump and the turbo began to whir. A brief spit and sputter and it all began to happen; water burst from the sample valves, and the phenomenon of permeation began. Fresh tasting water was being produced from the sea! Saying we were happy would have been an understatement. We all were quite emotional, and Dr. Keppler jumped into my arms. We danced in the water splashing onto the concrete floor and cheered with excitement like little kids. We had done it!

Thirty days, four guys, six phone calls, two emergency shipments, a few prayers, a few caipirinhas, and we were making water. In spec. We rushed back to our hotel, changed into clean clothes, and were whisked to the airport to catch our flight. On the way there, and while waiting for departure, I conducted the fastest operator training session that I have ever given.

My fiancée and I boarded the plane, and as we gained altitude—like the mythical legend of Brigadoon—the island vanished below. It was a magical time for me. It was the early days of TSG Water, and I was starting a new life with Anastasia. We have great memories of such a special place, and I was working in an industry that I have enjoyed for the past 31 years.

Epilogue: Matt says that his story is even better when told over a few beers.

In brief

The Bureau of Reclamation will hold its ***7th Annual Water Innovations and Networking*** (WIN) Workshop on 23-24 October in Alamogordo, New Mexico, at the Sargeant Willie Estrada Memorial Civic Center. For information, visit https://tinyurl.com/59b4jfrp.

New Jersey-based **Tidal Metals** has announced the closing of an $8.5 million seed funding round led by DCVC, with participation from First Spark Ventures and Bidra Innovation Ventures. The financing will fund the development and construction of a commercial pilot plant to demonstrate Tidal Metals' technology for extracting primary magnesium metal from seawater using efficient physical processes such as filtration, crystallization, and dehydration, followed by electrolysis to convert magnesium salt into metal. Tidal Metals recently advanced to the fourth and final round of the US DOE's HeroX Solar Desal Prize. The tagline from a company video is "Your next car is dissolved in the ocean."

Erratum: In last week's issue, it was reported that three consortia had submitted offers for the Saudi Water Partnership Company's (SWPC) **Jubail 4&6 independent water project**. However, only one consortium submitted an offer. That consortium included ACWA Power, Haji Abdullah Alireza & Co, and Al Sharif Contracting and Commercial Development.

France's **Osmosun** has announced the commissioning of six new solar-powered, battery-free SWRO units in isolated villages on four islands in the Republic of Vanuatu, an archipelago in the South Pacific. The units, which each have a production capacity of 1.5 m^3/d (400 GPD), will supply water kiosks. They will be assisted by Vanatu's national water agency, which has been trained by Osmosun, who will provide long-term support, facilitating local ownership of the equipment.

Morocco's Office Chérifien des Phosphates (OCP) Group has been granted €100 million ($111.6 million) to build a 219km (137 mi) cross-country water pipeline and pump station to transport desalinated water from **OCP Group's** Jorf Lasfar desal plants to Khouribga. Construction has already begun on the pipeline, which has a capacity of 80 million m^3/y (58 MGD). International Finance Corporation (IFC), a member of the World Bank Group, provided the grant.

The **City of Coral Springs, Florida**, has released a request for LOIs from firms interested in constructing a new 12 MGD (45,420 m^3/d) NF or RO plant to replace the city's existing lime softening treatment plant. A pre-proposal conference will be held on 2 October, and SOQs must be submitted by 4 December. The plant is scheduled to be operational in Q4 2031. Contact mmachuca@coralsprings.gov for details.

NamWater has entered into a joint venture with China General Nuclear Power Group (CGN) under which CGN's subsidiary, Swakop Uranium, will fund the construction of a 20 million m^3/y (14.5 MGD) SWRO plant. Construction should be completed by the end of 2026. The similarly-sized Erongo SWRO plant, operated by Orano Mining Company, currently supplies water to Namibia's coastal region.

The South Central Membrane Association (SCMA) will hold a Low-Pressure Membrane Operator Certification (MOC) training course in Rosharon (Pearland), Texas, on 16-18 October and in Fort Worth, Texas, on 29-31 October. For more information, visit https://tinyurl.com/3z34yabt.

The Water Environment Federation will hold its annual **WEFTEC** event in New Orleans, Louisiana, on 5-9 October. For information, visit https://tinyurl.com/35auz9uf.

Jobs

NALA Membranes seeks an **Applications Engineer** to work closely with the technical, product, and sales teams. The primary objective for this new customer-facing role is to establish NALA's capabilities for conducting pilot trials that validate our value proposition and provide customer solutions. The successful candidate should be willing to locate in North Carolina, and have a Master's or PhD in chemical engineering or a related field. Experience in membrane or water treatment technology, and hands-on installation or commissioning experience is required. For a full job description or to submit a CV, please send an email to: mariah@nalamembranes.com.