Case Study:

Low Energy Consumption, No Chemicals RO Plant

- The Bonaire Island Case Study

IDE Technologies | Your Water Partners

IDE Water Technologies

Background

The new Bonaire SWRO desalination plant, based on IDE Technologies reverse osmosis technology, was recently successfully commissioned.
The IDE desalination plant has added 5,600 m3/day to the existing desalination units in Bonaire, increasing the total water supply to 7,200 m3/day.
The plant is designed in a two train concept – each train has a production capacity of 3,200 m3/day, and each train can operate independently of the other train.
Additional units are currently being built by IDE Technologies to allow for additional capacity that will bring the total capacity to 9,600 m3/day.

Project Objectives:

- Compliance with product quality requirements at all times, under a wide range of operation conditions.
- Flexibility of operation as a result of the IDE modular approach.
- Low energy consumption.
- Chemical free process.
- Fully automated and highly reliable plant.
- High end construction materials.

Low Energy Consumption

As low energy consumption was of great importance in the plant design, measures were taken to ensure a low guaranteed value of 2.87 kwh/m3 where in effect, the actual consumption achieved was 2.59 kwh/m3.
These measures include process design at low recovery and flux, selection of low energy membranes, and choosing equipment with high efficiency. The design also includes an energy recovery system (ERS) that maximizes the energy efficiency of the SWRO process.

Modular, Preassembled Design Approach

The preassembled and modular unit concept is a project delivery strategy developed by IDE Technologies, Ltd. The goal of this strategy is to provide desalination plants that:

- Are the best in class in terms of safety, quality, and performance.
- Have the lowest total installed cost.
- Can be installed in the shortest time.
- Minimize site plant execution risks.

In the preassembled and modular unit concept, a significant portion of the plant fabrication, assembly and testing is completed off-site, under controlled plant conditions and precision tooling, using the same materials and designed to the same codes and standards as conventionally built facilities – but in much less time.

The preassembled and modular unit concept allows a reduction in installation time and costs, as modules are simpler to install than components delivered loose and assembled on site. In addition, since the total installed cost of the project is extremely well defined in the design process, and the installation scope is clear, the owner is at significantly less risk as a result of construction related change orders and delays.

As module fabrication can occur simultaneously with site improvements and foundation work, projects can be completed sooner compared to traditional construction. In addition, the need for highly skilled construction personnel (i.e., welders, pipefitters, machinists, etc.) onsite is reduced, as are potential delays attributed to inclement weather during construction.

Shortening the onsite erection time offers considerable potential savings to the EPC contractor, and a shorter overall schedule, which results in an earlier start to water production.

Chemical Free Process

The WEB Bonaire desalination plant provides the required product quality without the use of any chemicals. This is achieved by direct osmosis cleaning (DOC) - a high-end, patented technology developed by IDE that utilizes osmotic pressure to clean the membranes in a short and repetitive process, removing biofouling and scaling from the membranes.

Learn More >>

Main Plant Components

Pretreatment (Pressurized Multi-Media Filters (PMMF), Micronic Filters)

Pretreatment of seawater prior to the SWRO process, to remove suspended solids and minimize the growth of microorganisms on the membranes, is of critical importance to the reliability of any SWRO process. Effective pretreatment is thus necessary to increase the efficiency and life span of the SWRO system. Selection of proper pretreatment minimizes fouling and membrane degradation, resulting in optimized product flow, salt rejection, product recovery and operating costs.
The pretreatment process includes fully automated pressurized multi-media filters (PMMF), followed by micronic filters.

Seawater Pretreatment

Pretreatment of seawater prior to the SWRO process, to remove suspended solids and minimize the growth of microorganisms on the membranes, is of critical importance to the reliability of any SWRO process. Effective pretreatment is thus necessary to increase the efficiency and life span of the SWRO system. Selection of proper pretreatment minimizes fouling and membrane degradation, resulting in optimized product flow, salt rejection, product recovery and operating costs.
The pretreatment process includes fully automated pressurized multi-media filters (PMMF), followed by micronic filters.

Seawater Reverse Osmosis (SWRO)

Downstream of the PMMF, the water is distributed to the SWRO units. Before the pretreated seawater enters the SWRO, it passes through micronic filters. One micronic cartridge filter is installed for each SWRO unit. The micronic filters serve as safety filters against fouling agents that could harm the RO membranes, HPP and the ERS units (PX).

Seawater Reverse Osmosis (SWRO)

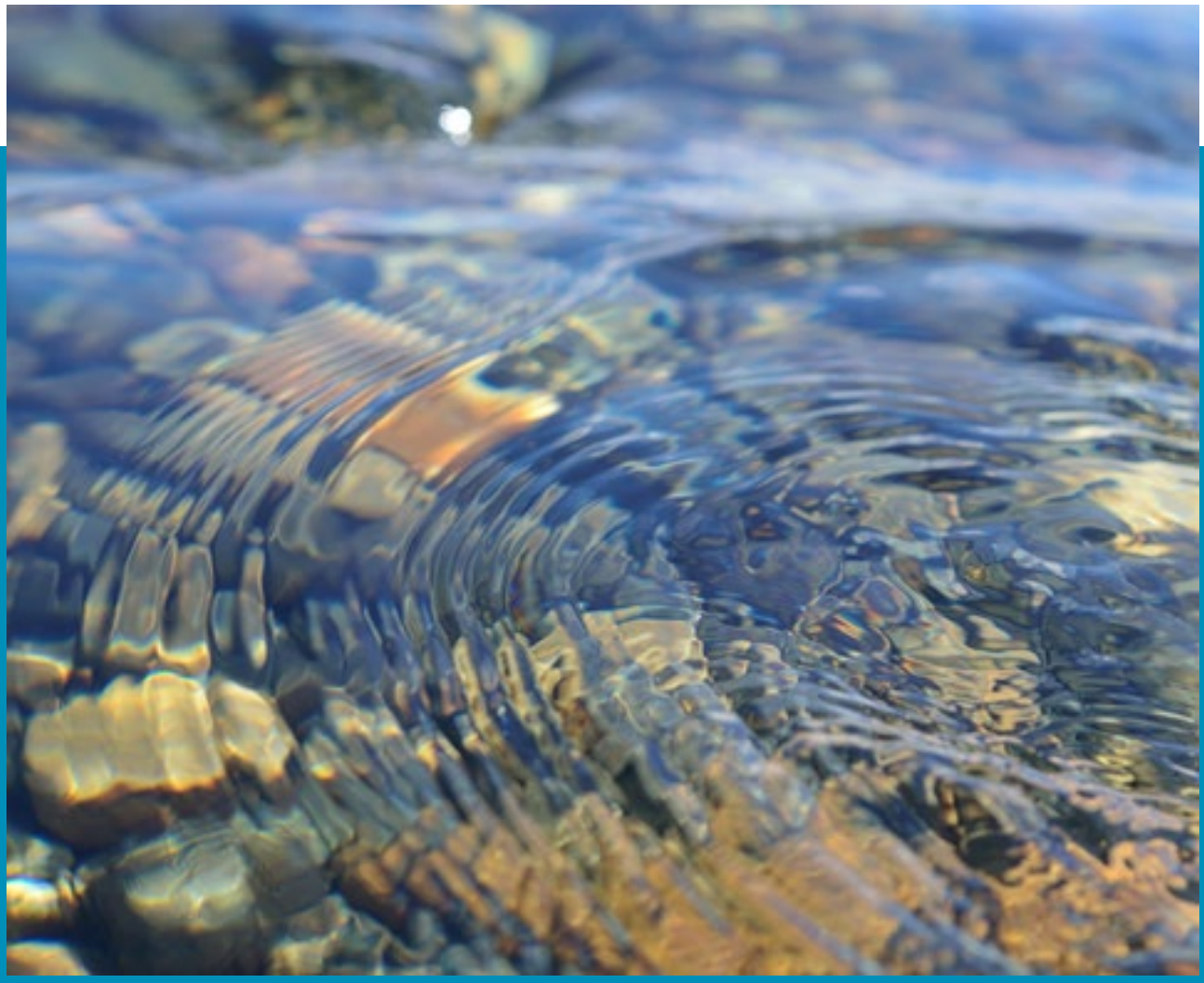
The seawater reverse osmosis (SWRO) stage is the core process of the desalination plant. The SWRO process is performed by forcing the seawater through a semi-permeable membrane at high pressure to produce permeate water.
The desalination section comprises of the SWRO membrane units, high pressure pumps (HPP) and energy recovery system (ERS). The system is divided into two trains, one train contains two SWRO units and the other includes three units. Each train is hydraulically independent, and each unit operates with a high pressure pump, energy recovery system and ERS circulation pump. Fourteen pressure vessels (each containing 8 elements) are installed on each unit, according to the capacity requirements.
SWRO permeate water quality is monitored by a conductivity meter on each SWRO unit.
In case of quality failure, the permeate will flow automatically into the brine gutter, until quality improves. The SWRO permeates from each unit flows into two suck-back (buffer) tanks.
The low pressure brine from the ERS flows to the backwash tank, used to BW the PMMFs.
The SWRO units are fully automated and controlled by two set points: the permeate flow rate and the SWRO recovery. The permeate flow meter controls the HPP VFD in order to reach the permeate flow rate set point. The flow rate of the low pressure brine set point is calculated from the recovery and permeate flow rate set points. The low pressure brine flow rate is then controlled by the low pressure brine valve. The valve position is controlled by the brine flow meter, in order to reach the brine flow rate set point.

Brackish Water Reverse Osmosis (BWRO)

The brackish water flows to the second pass from the suck-back tanks. The second pass is divided into five units that include a 2nd pass pump and two stages: 1st stage with four pressure vessels and 2nd stage with two pressure vessels. The brine of the 1st stage is the feed of the 2nd stage, and the brine of the 2nd stage blends with the seawater that feeds the same SWRO train.
The operation of the BWRO is automatically controlled by a permeate flow rate set point that controls the brine control valve, as well as by a feed flow meter that controls the feed pump VSD. The feed flow rate set point is also corrected according to the level of the suck-back tank in a cascade PID loop.
The permeate of the 2nd stage of each unit is collected and connected to the tie-in point, in order to transport the BWRO permeate through the existing post-treatment towards the existing drinking water tanks of Hato. Before the tie-in point, the BWRO permeate pressure, flow rate and conductivity are continuously monitored.
There is an online conductivity meter in each BWRO unit. If the permitted water conductivity is exceeded, the unit will automatically go to off-spec until the quality is corrected.

Summary

With onsite commissioning, and training of the local team behind us, IDE is proud to have partnered with WEB Bonaire to provide the island of Bonaire with a reliable SWRO desalination plant to provide drinking water to the population in these challenging pandemic times.



For more information on IDE Water Technologies' comprehensive water solutions >>

IDE Technologies, Hamatechet St, Hasharon Industrial Park, Kadima, Israel