



# Improvements to the Reverse Osmosis process at the Water Treatment Plant in Sant Joan Despí

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**Sant Joan Despí is one of the world's largest Water Treatment Plant (WTP) combining UF and RO technologies to treat river water representing a significant advance in inland surface water treatment for potable purposes. Situated in a region close to Barcelona, the WTP is the nerve centre of the water treatment and supply system to the metropolitan area of Barcelona.**

Location	<b>Barcelona</b>
Developer	<b>Aigües de Barcelona</b>
Start-up date	<b>June 2007</b>
Finishing date	<b>2009</b>
Capacity	<b>230,000 m<sup>3</sup>/day</b>
Technology	<b>Ultrafiltration and Reverse Osmosis</b>
Water quality	<b>S/RD 140 / 2003</b> <b>THMs&lt;100 µg/l</b>

The existing drinking water treatment plant in Sant Joan Despí collects and treats water from the Llobregat River and its aquifer and is the centre for water treatment and distribution supplying the Barcelona area.

The water from the Llobregat River, whether coming from the surface or underground, does not generally satisfy the organoleptic requirements for potable water. Its greatest problem is the high level of salinity. This is mainly because of the potassium hydroxide mines located along the riverbed and because of certain factors such as conductivity, temperature, chlorides, sodium and potassium. Furthermore, variable levels of organic matter have also been detected. This problematic situation is increased because of the circumstances characteristic of a river located in a Mediterranean environment.

Both because of the organic matter content and because of the high level of bromides coming from the exploitation wastes of the potassium hydroxide mines, when this water is disinfected with chlorine, by-products known as trihalomethanes are created. Royal Decree 140/03 strictly controls these substances requiring that, their concentration be less than 150 µg/l as of 2004 and under 100 µg/l by 2009.

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The installations designed define the works necessary to treat a nominal water flow of 2.78 m<sup>3</sup>/s with ultrafiltration and reverse osmosis, giving a product water flow of 2.385 m<sup>3</sup>/s. When this is mixed with the rest of the flow currently treated at the existing plant, its production capacity is sufficient to guarantee a final flow of water with the quality required by the law mentioned above.

### The solution chosen

Connection of untreated water	<b>Water under the existing sand filters</b>
Ultrafiltration	<b>Submerged membranes ZW1000 9 trains with 8 units/train and 57 modules/unit</b>
Ultrafiltered water tank	<b>1,500 m<sup>3</sup></b>
Pumping of ultrafiltered water to ROI	<b>12 vertical pumps</b>
UV disinfection	<b>5 lines with 530 l/s under pressure Before and after cartridge filters</b>
Cartridge filters	<b>5 filters 5 μ</b>
High pressure pumping	<b>10 high pressure pumps at 1<sup>st</sup> stage 10 booster pumps between stages 2 &amp; 3</b>
Reverse Osmosis	<b>10 R.O. support frames</b>
Remineralization	<b>Doses of CO<sub>2</sub>, Calcite beds and blending</b>
Treated water tank	<b>9,570 m<sup>3</sup></b>

### Ultrafiltration

#### Operational sequence

- Production
- Back-washing / solid dilution in the tank (every 15-60 min).
- Maintenance cleaning (4 times/week with hypochlorite 12 cleanings/year with phosphoric acid).
- Recovery cleaning (12 cleanings/year with hypochlorite; 12 cleanings/year with phosphoric acid)

#### Auxiliary equipment

- Cleaning blowers
- Permeated pumps
- Backwashing pumps
- Vacuum pumps
- Chemical solution conveyance pumps
- Dosing pumps

### Reverse Osmosis

#### Operational sequence

- R.O. racks, each with a capacity of 20,606 m<sup>3</sup>/day
- 90% conversion. Intake flow 228,960 m<sup>3</sup>/day
- Configuration of each rack: 1 step, 3 stages
- Pressure pipes per rack
  - o 90 tubes with 7 membranes in 1<sup>st</sup> stage
  - o 40 tubes with 7 membranes in 2<sup>nd</sup> stage
  - o 28 tubes with 7 membranes in 3<sup>rd</sup> stage
- 1106 membranes per rack, brackish water type, size 8" x 40", spiral wrapped, 400-440 ft<sup>2</sup> surface area

#### Operation of R.O. racks

- Modularity
- Conditioning parameters for operation
  - o incoming water temperature (7 to 27°C)
  - o Solids (STD) in feed water (800 to 1510 mg/l)
  - o Age of R.O. membranes (1 day to 5 years)
- Feed pressure control
  - o High pressure pump speed control (1<sup>st</sup> and 2<sup>nd</sup> stages)
  - o Booster pump speed control (3<sup>rd</sup> stage)
- Permeated flow/conversion control:
  - o 1<sup>st</sup> and 2<sup>nd</sup> stage conversion: permeated pressure control
  - o 3<sup>rd</sup> stage conversion: reject outlet pressure control

