



Palma de Mallorca I Wastewater Treatment Plant

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Location	Palma de Mallorca
Customer	Ministry of the Environment
Starting Construction date	1999
Construction period	17 months
Capacity	46,000 m³/day
Average hourly flow rate	1,917 m³/h
Population	460,000 e.i.

The Arenal area in the city of Palma de Mallorca and the surrounding municipalities had initially had the PALMA I Wastewater Treatment Plant since the beginning of the 70s, a facility which has now become obsolete, updating and modification of the above ensuring that treatment processes are adapted to the requirements of current legislation and that treatment capacity is in line with the increase in population experienced in the last few decades.

The reuse of treated water for irrigation also requires the following effluent water quality conditions:

BOD ₅ :	<10 (mg/l)
SS:	<10 (mg/l)
Total N:	<10 (mg/l)
Total P:	<1 (mg/l)
Turbidity:	<5 NTU
Total coliforms:	<100 ufc/100 ml
Nematodes:	<1 egg/1l

The new PALMA I Wastewater Treatment Plant occupies an 11 Ha plot of land located in Pla de San Jordi.

The work carried out consists of:

1. Two pipelines, one for raw water and the other one for sludge from the PALMA II Wastewater Treatment Plant, 10,300 Km long
2. One pumping station for raw water and mixed sludge from the PALMA II Wastewater Treatment Plant to the new PALMA I Wastewater Treatment Plant.
3. The new PALMA I Wastewater Treatment Plant where treated water is pumped to the Son Ferriol basin.

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The pump station has four working lines: water treatment, sludge treatment, biogas storage and use and ancillary facilities, which we will briefly describe below.

Water line

- **Station for pumping raw water from the PALMA II Wastewater Treatment Plant:** Raw water pumping consists of four submersible pumps with unit flow rates of 958 m³/h. The maximum flow rate to be pumped is 1,500 m³/h and the average flow rate is 23.000 m³/d. The pipelines are made of ductile cast iron, 10,300 m long and with a 600 mm diameter.
- **Inlet pit. Screening:** This headworks receives raw water arriving from the different pumping points and the water driven through the new sewer that links PALMA II Wastewater Treatment Plant with PALMA I. This headworks has a bypass spillway to the plant bypass chamber and a pulley with a bi-valve bucket to remove sedimented and floating solids.
- **Grit removal:** Following screening, the grit removal-degreasing process is carried out. Both grit and grease are concentrated and separated into two equipment units and are stored, until transport to the waste disposal area, in suitable containers.
- **Primary sedimentation:** This is carried out in three 27 m diameter clarifiers. All three have an arched aluminium enclosure with a deodorization system that makes it possible to reduce surrounding smells.
- **Biological treatment:** The biological treatment proposed by activated sludge is one of the most outstanding new features introduced at this facility, because it permits treatment versatility in accordance with the seasonal conditions that may arise. Three lines have been built that can operate independently or together and optional lines have been proposed that make the process similar to a Johannesburg process or another conventional type depending on the configuration of these chambers as

oxic or anoxic areas. This ensures nitrogen removal, even in the highest BDO5 pollution ranges. There are three anoxic tanks, three oxic tanks, two optional ones and one final re-aeration tank.

- **Secondary sedimentation:** biological sludge is separated from the mixed liquor in three 40 m diameter secondary suction clarifiers.
- **Tertiary Treatment:** Following biological treatment and pollutant reduction, treated water quality requirements means that more advanced water treatment is necessary. This quality improvement is achieved by water coagulation and flocculation tanks, which, following subsequent filtration, allow the water to be totally reused as irrigation water in areas near the facility. The water filtering and disinfection system is a technological variation on the traditional travelling bridge system used by the contractor.

Sludge line

- **Primary sludge screening and thickening at Palma I Wastewater Treatment Plant:** Sludge extracted in primary sedimentation is screened and thickened by two gravity thickeners.
- **Mixed sludge screening and pumping from Palma II Wastewater Treatment Plant:** To totally remove sludge produced at Palma II Wastewater Treatment Plant, mixed sludge is screened and driven by four screw pumps with a 62.5 m³/h unit flow rate. The sludge line is the longest built in Europe to date.
- **Reception of mixed sludge from the Palma II Wastewater Treatment Plant and mixing with excess sludge from Palma I Wastewater Treatment Plant:** This facility receives sludge from Palma II Wastewater Treatment Plant, the daily amount received being 3,000 m³/d of 1% dryness sludge. This tank also receives excess sludge from the biological process.



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- **Mechanical thickening of mixed sludge (mixed and excess):** Sludge is thickened by four mechanical thickening units with a 90 m³/h thickening capacity. The concentration obtained is 6% and it is necessary to add poly-electrolyte.
- **High capacity anaerobic digestion:** sludge digestion takes place in four high capacity anaerobic digesters with a volume of approx. 28,000 m³. Volatile reduction is > 45%.
- **Buffer tank and mechanical dewatering:** To control sludge production and to achieve even feeding to the dewatering process, there are two 2,977 m³ capacity tanks. To achieve 25% dewatered sludge dryness, four high dryness centrifuges have been installed.
- **Storage in silos:** The dewatered sludge is pumped by two screw pumps to two 100 m³ capacity silos.

Biogas line

- The biogas created in the digestion process is used to heat the sludge by means of two boilers with a mixed type burner. Biogas is stored in two double membrane gas-holders with a unit capacity of 2.250 m³.

Auxilliary facilities

- **Primary clarifier roof:** To reduce bad smells generated, three aluminium domes have been installed to cover the clarifiers. This air is collected by means of three fans connected to a chemical deodorization process to minimise the environmental impact.
- **Deodorization:** The new treatment plant and pump station have chemical deodorization systems to minimise the impact on the environment.
- **Landscape integration and environmental monitoring:** Another aim of this Project has been to minimise the environmental impact of the facility and its landscape integration in the Plá de Sant Jordi area. Two mills of great historic value in the area have been restored, and measures have been introduced to reduce noise and smell in order to be respectful with the environment.

