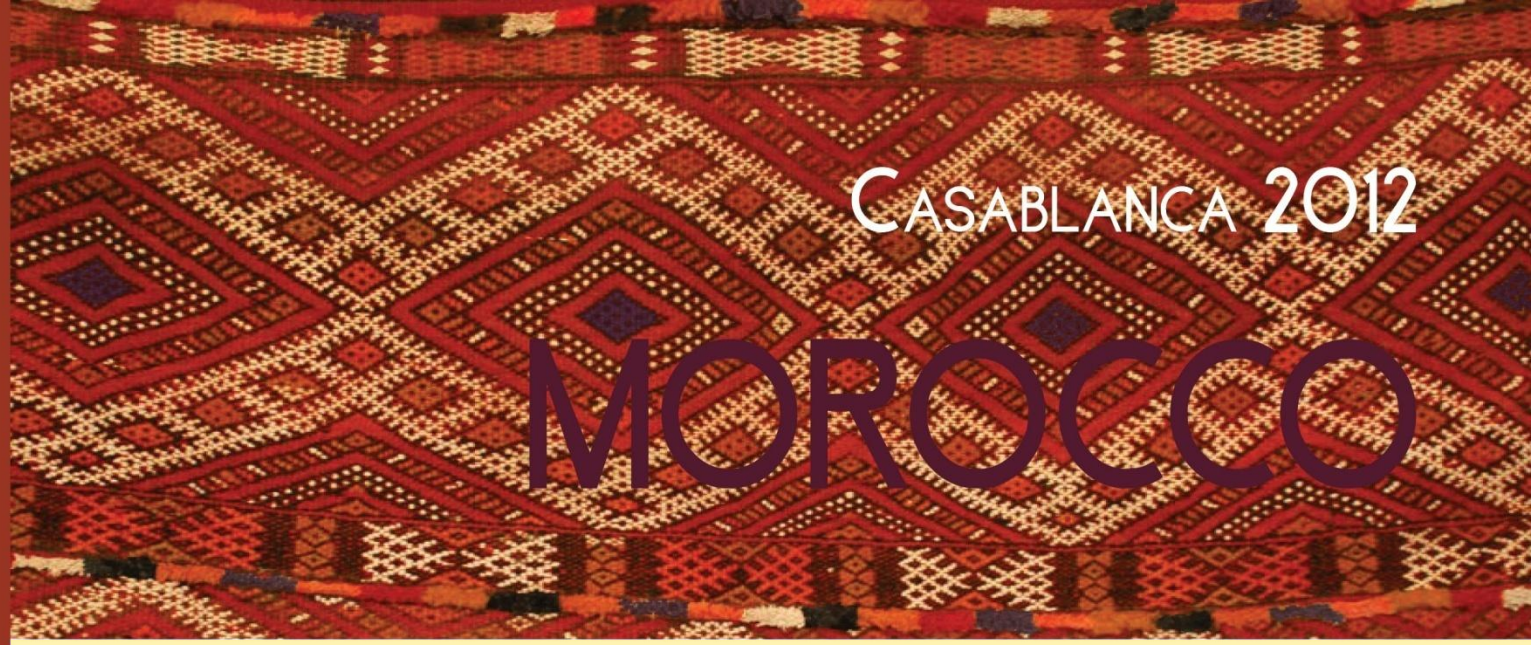
INTERNATIONAL CONFERENCE ON DESALINATION AND SUSTAINABILITY

1 - 2 March 2012



Spanish Desalination Plan: Environmental Considerations and Solutions

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MOR12-004

in cooperation with

supported by

DESALINATION Origin of the Spanish program

- On the Mediterranean coast of Spain population increased at high a speed because of vacation homes.
- At the same time the Spanish levant is home to one of the most florishing agricultures and in a position of competitiveness with other Mediterranean countries.

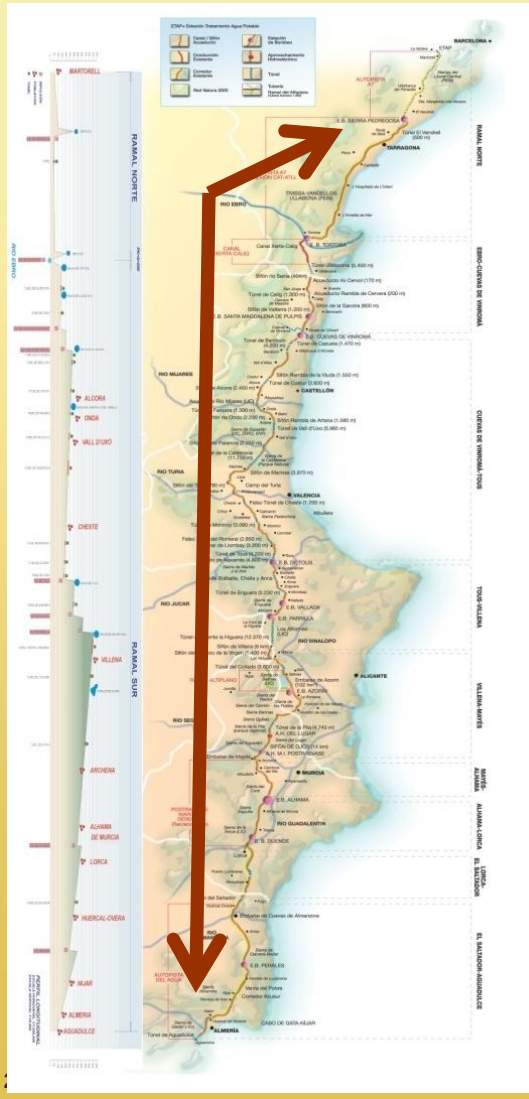
Restrictions during periods of drought are almost a routine, it is difficult to satisfy requests

→ restrictions for three or four years of each decade

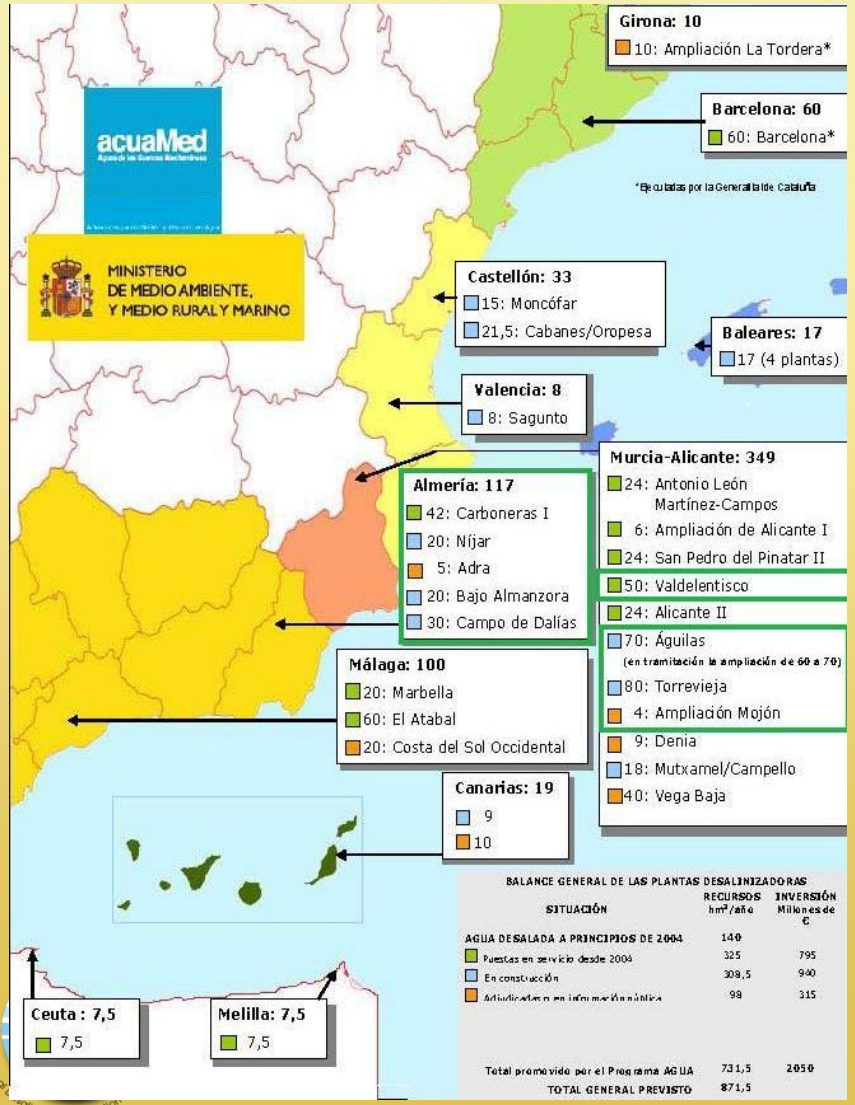
DESALINATION Origin of the Spanish program

The theoretical capacity of the water transfer between the Tagus and Southeast is of about 600 hm³/year but the amount of water transferred is reduced every year

There was a project of transfer from the Ebro but in 2004, the new Administration decided that this transfer from the Ebro (1050 hm3) could not be built



DESALINATION Origin of the Spanish program



Efforts are mainly directed to modernization of irrigation and wastewater reuse

it was evident that these efforts, while useful, could not provide enough water to solve the matter.

Desalination was the most original initiative because it had never been used at a large scale until then.

DESALINATION Environmental Considerations.

- **Desalination provides warranty of quality water, inexhaustible and obtained by sustainable methods, necessary where traditional resources are limited**
- **AcuaMed has 16 building desalination plants (~ 440 hm3/year)**

?

What to do to ensure the correct procedures from the point of view of the environment?

DESALINATION Environmental Considerations

- All plants have undergone a procedure to obtain a positive declaration for impact on the environment with specified controls that ensure a minimum affection
- Each desalination plant worksite receives specific technical assistance unrelated to the contractor.
- Desalination plants have a watch program of the impact on the environment which certifies the application of preventive and corrective measures in the construction phase and it provides data for a rapid and effective solution in case of alerts the hypersaline discharge in operational phase

TWO BASIC ELEMENTS

- **Project which properly analyses the impact on the environment in the land and marine environments**
- **Marine environmental monitoring program**

The Plan of supervision on the environment provides

- control of the continuity of the receiving environment and its adequacy to the uses and characteristics of water quality standards
- control over the conditions of habitability of the beds of Posidonia oceanica and Cymodocea nodosa next to the zone of influence of saline rejection.

1 – Project and pre-operational Phase

2 – Site Phase

3 – Operational Phase

Project.
Impact on the environment due to implantation of a desalination plant

Occupation of the territory by a desalination plant and its annexes works

Discharge of brine in the sea. Correct point of rejection choice and a good project of diffusion elements minimize the effect

CO2 emission due to the use of energy, as any other system of water distribution. Use of alternative energies and energy recovery devices

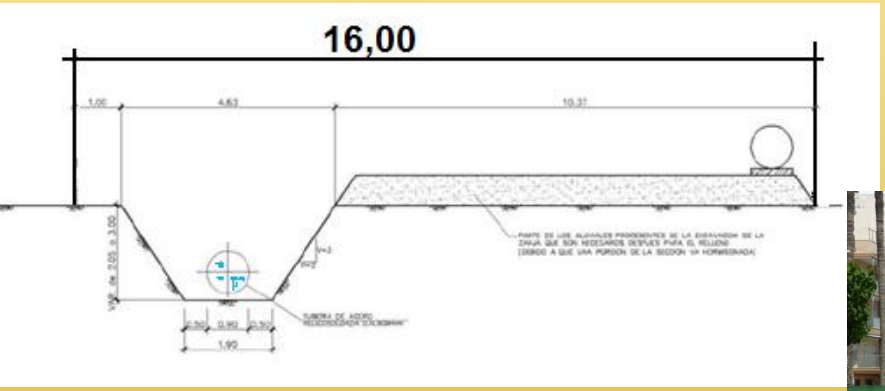
Land occupation by the plant

Torrevieja's Plant

240.000 m^3/day, the 6th in the world in capacity

Land occupation by the plant

Evaluate impact of infrastructures and additional land occupation depending on the territory carachteristics .



CRITERIA FOR SELECTING THE LOCATION WITH MINIMUM IMPACT ON MARINE ENVIRONMENT.

- *The location of desalination plants should have minimum impact on benthic impact areas*
- *• They should be outside of protected natural areas and priority habitats*
- *• Search for locations devoid of vegetation due to natural dynamics. Dry riverbeds*
- *• Find sources of good quality water to minimize chemical treatment. wells, open intakes.*

criteria for selecting the location with minimum impact on marine environment

•Location where there is already human activity that prevents the development of vegetation, if their use continues. Ports, wharves.

•Location of works on existing infrastructure. Dikes, pontoon.

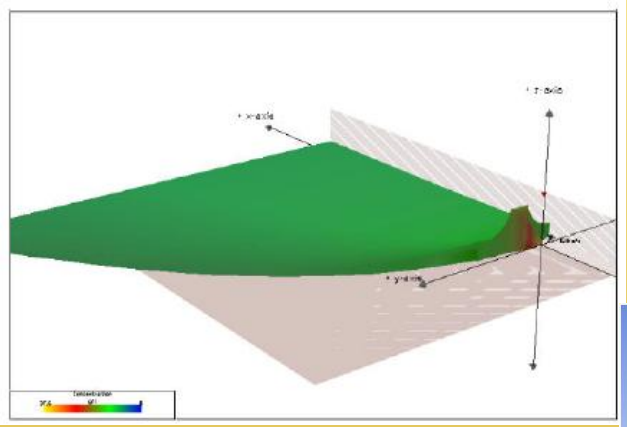
•Place works by taking advantage of the corridors created by other infrastructure.

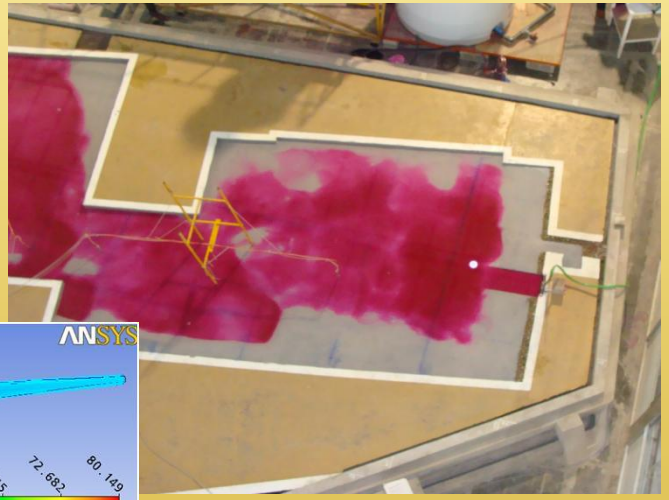
•Use existing emissaries to other treatment plants in water or thermal power stations or rejection in channels, dry beds of rivers or emissary directlyire.

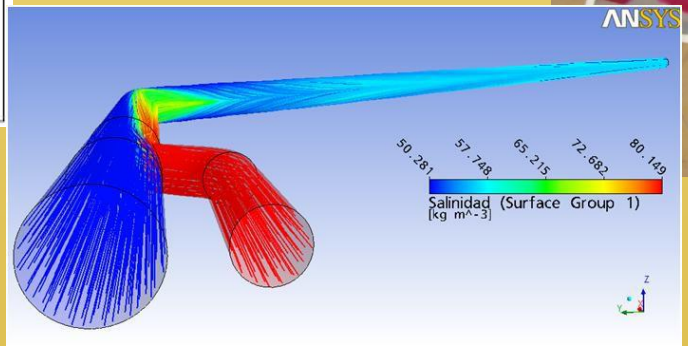
Analyse préalable du milieu marin

• Selection of simulation models of the plume of rejection and determination of the quality of the dilution: CORMIX, COHERENS.

• Geometrical characteristics of the discharge by integrating the information in the section of the diffuser in the studies of the physical models of the dispersion of brine and based on previous studies







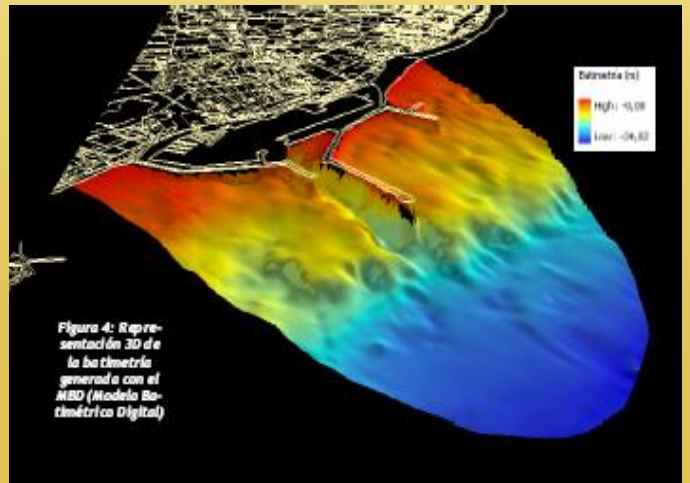
Analyse préalable du milieu marin

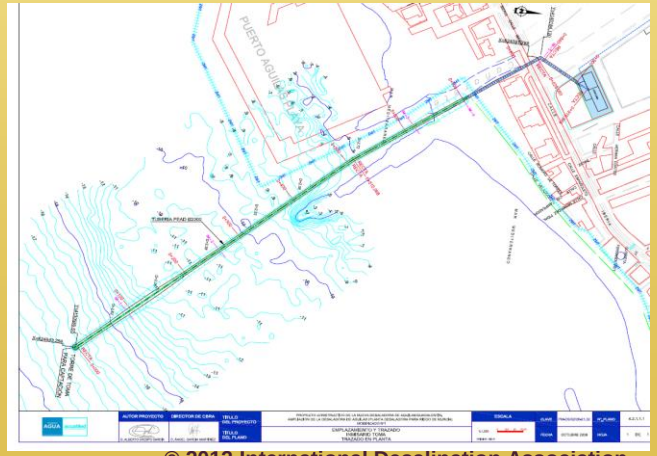
Characterization of the receiving environment: physical environment

- bathymetry of retail
- the funds of the zone characterization study
- coastal hydrodynamics and flow analysis: tides, currents
- Interpretation of local disturbances due to the effect of the hydrodynamics of the construction of wharves, breakwaters**, etc..**

Characterization of the receiving environment: chemical environment

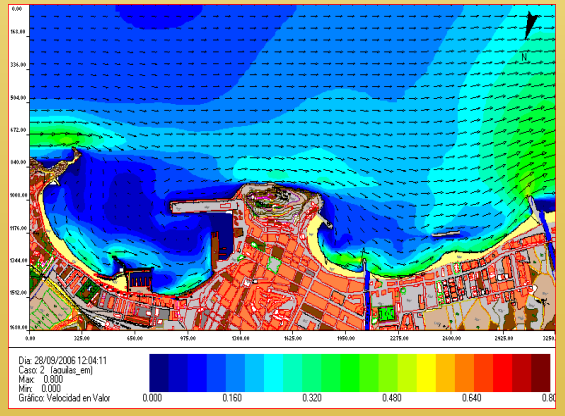
- Characterization of water (pH, solids in suspension, salinity and temperature)





Pre-operational phase. Definition of the zero position (initial).

- Record of bathymetry and the currents. Install a device for measuring 1 m from the bottom in the vicinity of the future point of discharge (min. 1 month)
- Sediment characterization
- Analysis of the hydrodynamics of the coast: tides and currents. Interpretation of local disturbances
- Characterization of the water column (pH, suspended solids, dissolved oxygen, nitrate, etc..) The identification of the curves of temperature and salinity profiles



Analyse préalable du milieu marin

Needs:

- Establish what are the limits of tolerance for the different Mediterranean benthic communities that could be affected by discharges.
- Studies of tolerance to the salinity by Posidonia oceanica and Cymodocea nodosa. Evaluate these thresholds by characterizing the environment where the spill occurrs.

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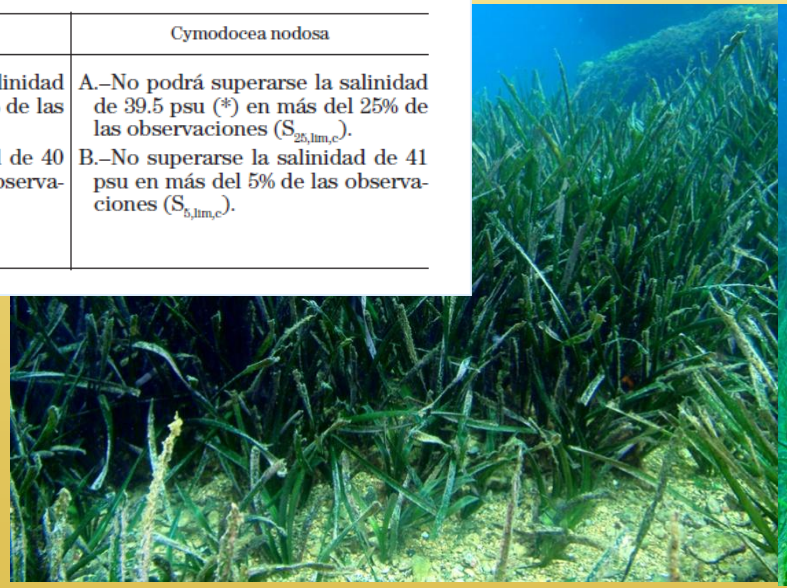
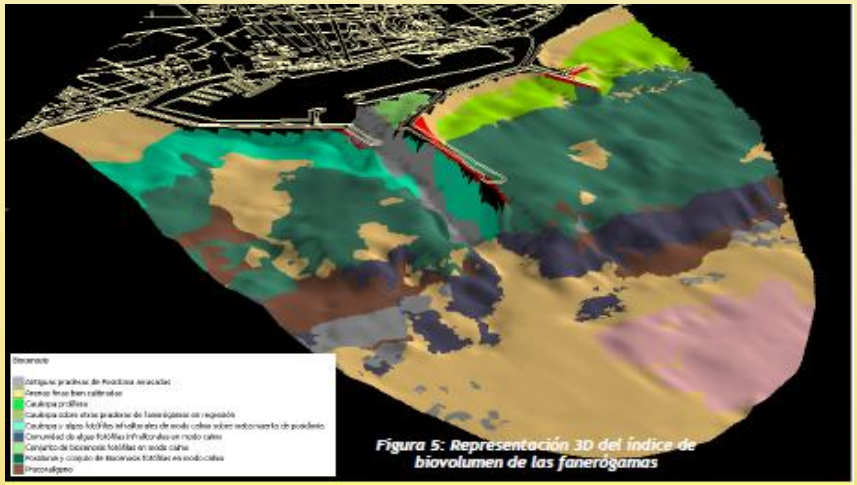
Posidonia oceánica	Cymodocea nodosa
A.–No podrá superarse la salinidad de 38.5 psu en más del 25% de las observaciones ($S_{25,lim,p}$).	A.–No podrá superarse la salinidad de 39.5 psu (*) en más del 25% de las observaciones ($S_{25,lim,c}$).
B.–No superarse la salinidad de 40 psu en más del 5% de las observaciones ($S_{5,lim,p}$).	B.–No superarse la salinidad de 41 psu en más del 5% de las observaciones ($S_{5,lim,c}$).

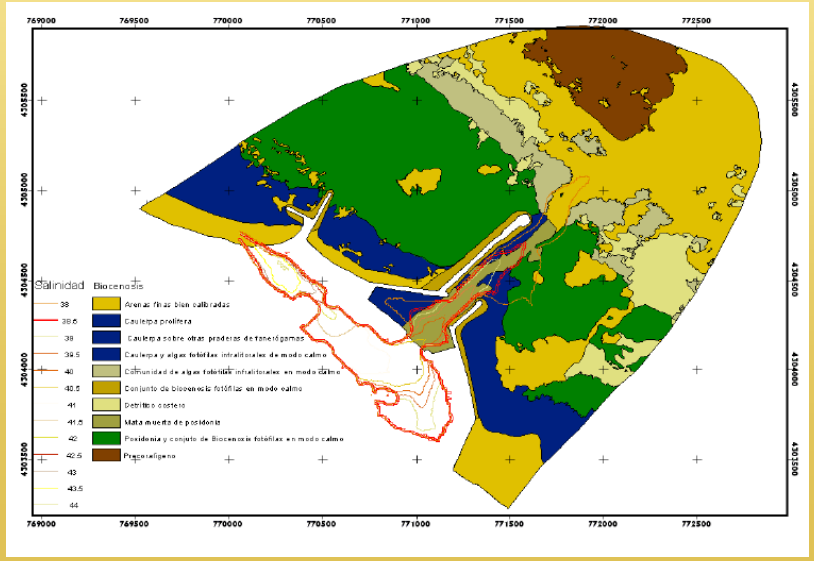


Analysis of the marine environment

Characterization of the biotic receiving environment

- Identification of the biocenose
- Description of the seed beds and other marine organisms (biogenic, reefs crustaceans, molluscs)
- Structural parameters: calculation of the coverage, bioecological indicators, calculation of the density of the beam

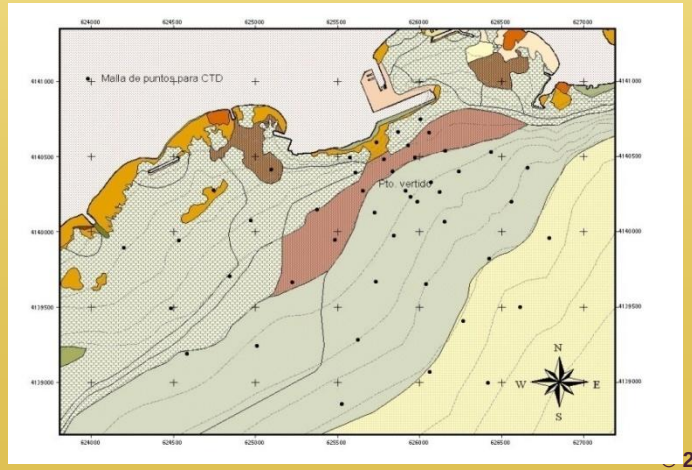




Survey program in the marine environment

Pre-operational phase. Definition of the zero position (initial).

- Curves of temperature and salinity
- Characterization of the conservation of aquatic plants and other marine organisms
- definition of the lower limit of the herbaria.
- Characterization of the density of the bundles of leaves.
- Speed of growth and production of rhizomes.
- Installation of monitoring stations that will define the future ESP during operation, in agreement with the integrated environmental authorization controls.



Remedial and preventive actions in the marine environment in the DIE

Needed:

1. Optimization of systems to run the trenches of dredging
2. Installation of screens anti turbidity
3. Analysis of the work schedule minimize conditions of the site in summer

Remedial and preventive actions in the marine environment in the DIE

Écrans antiturbidité

Remedial and preventive actions in the marine environment in the DIE

Construction on land and boat transport to the site

Remedial and preventive actions in the marine environment in the DIE

Machinery destined to reduce

affection to a minimum

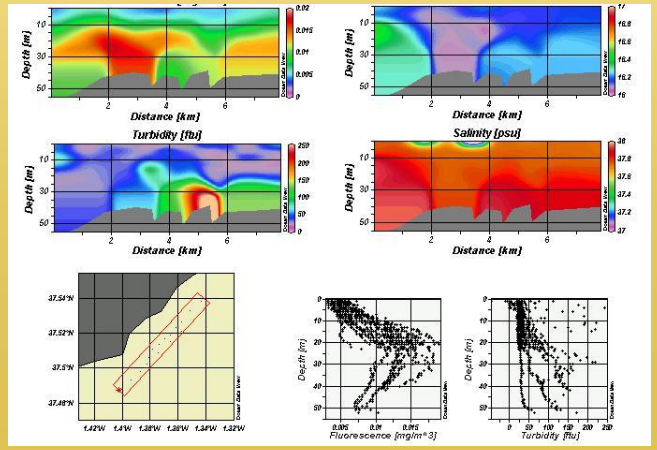
Survey program in the marine environment

2- Construction Phase

- Follow up of physical and chemical parameters in the initial situation.
- Monitoring of the behaviour of the prairies of Posidonia and others. Spaced 6 months to coincide with the winter and summer seasons (time of flowering of marine organisms, biogenic reefs, echinoderms, and mollusks)
- Visual inspection of sites by qualified personnel (divers)
- Quality control of the product of dredging

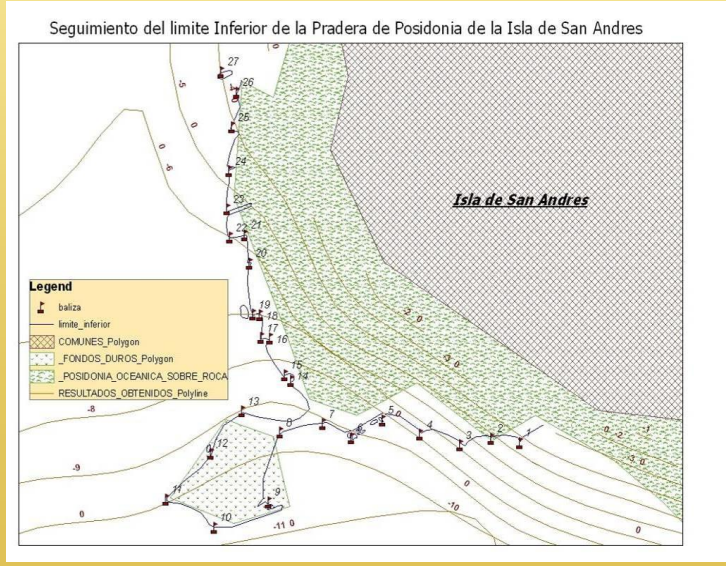
3 - Operational phase

- Installation of monitoring stations
- Control of the quality of the receiving environment
- Samples every 3 months at each sampling point
- Analysis: pH, dissolved oxygen, total phosphorus, TOC, total nitrogen, nitrate, ammonium, turbidity and conductivity
- Profiles of temperature and salinity along the water column, at least at the surface and depth called secchi (turbidity disc) and on the bottom.



3 - Operational phase

- Control of the quality of the effluent
- Characterization space-time salinity caused by the boom of rejection
- Control of possible affection on the prairies of Posidonia and other marine organisms (biogenic, reefs echinoderms, molluscs),
- Structural monitoring of pipes



ns la mer

Different types of rejection

Conclusions

The Spanish program destined to bring new resources through desalination has tried to satisfy all needs and reduce affection to the environment to a minimum

The program also took steps to avoid of future controversy on the effects of desalination and their convenience and especially in the marine environment

THANK YOU FOR YOUR ATTENTION

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in collaboration with the Environement Direction of ACUAMED