



# **MONITORING OF THE TURBIDITY PLUMES GENERATED DURING DISPOSAL OF DREDGED MATERIAL IN THE OPEN SEA**

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# ENVIRONMENTAL PERMIT TO DREDGE ACTIVITIES

- **CONAMA 001/86 e 237/97**
- **CONAMA 344/04**





# LICENSE PREMISES

- **Sediments Characterization**
  - **Disposal Options**
- **Environmental Impact Assessment**
- **Environmental Monitoring**





## **DISPOSAL OPTIONS**

- **Potencial disposal areas identification and characterization**
- **Studies of Dispersion and sedimentation of spill from disposal activities**
- **Environmental Impact Assessment of Disposal Activities**





# MODEL SIMULATIONS Uncertainty

- Database
- Calibration
- Validation





## **PURPOSE OF THIS STUDY**

**To Validate the Model Simulations with regard to the maximum spreading of the dredging spoil by comparing them to the measured values in the initial phase of dredging.**





## **SPECIFIC OBJECTIVES**

- **To document sediment spreading from the disposal site by field survey**
  - **To verify sediment settling characteristics**
- **To verify results of numerical modelling**
- **To plan follow-on monitoring activities throughout the dredging operation**





## STRATEGY

**Plume tracking and measurements were carried out by two methods conducted:**

**A. Mapping of the plume by a navigating in a zig-zag pattern trough the plume and/or longitudinally through the plume**

**B. Turbidity measurements on fixed location in the plume immediately after discharge.**







# PROCEDURES

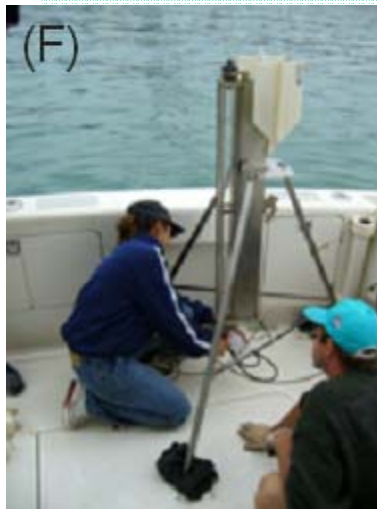
1. To install the meteoceanographic equipments near the studied area
2. Plume tracking by turbidity sensor (OBS) towed at fixed depth and current measurements by Acoustic Doppler Current Profiler (ADCP).
3. Setting and tracking of drift buoys launched in the plume. Concentration profiling by turbidity sensor.





# PROCEDURES

4. Sampling of water samples for settling velocity tests.
5. Aerial photo coverage was done during several of the plume discharges.
6. Calibration of the sensors (REA & REO)

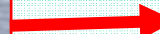


**tubo de decantação  
Valleport SK110**





# DREDGE ACTIVITY



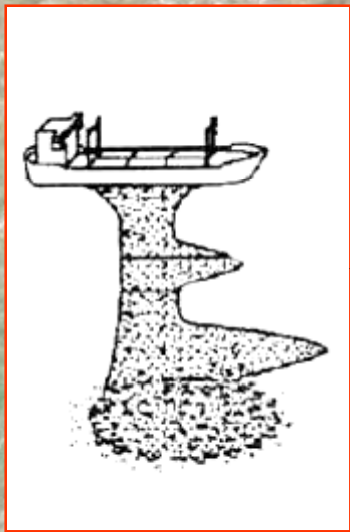
# Disposal Operation



turbidity plumes

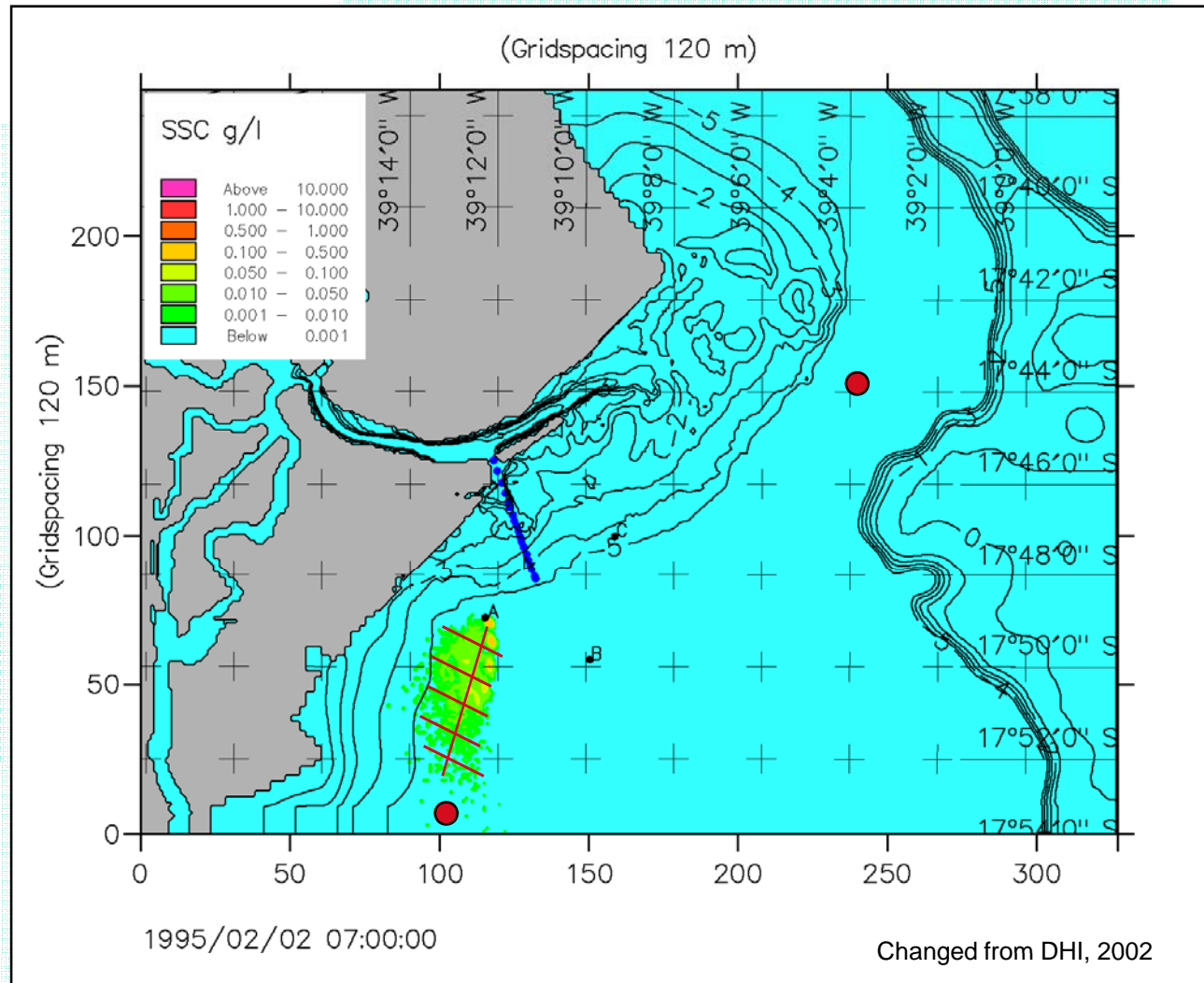


Dredge





# METODOLOGIA



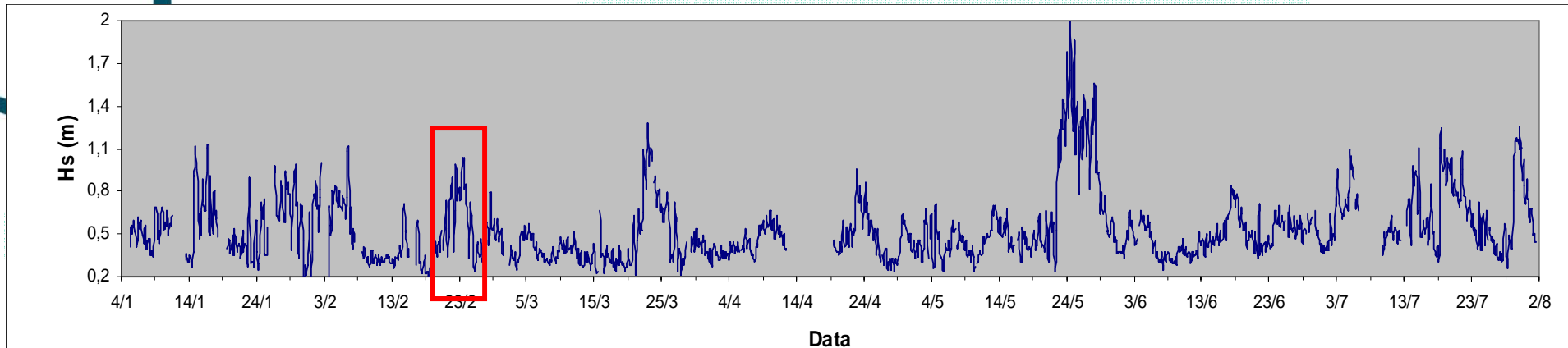


# SURVEY

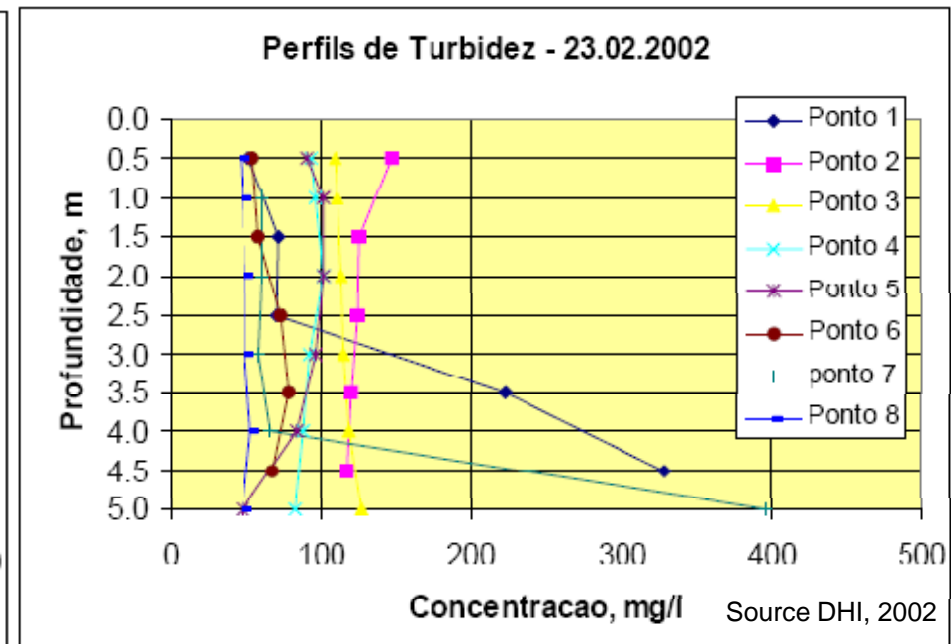
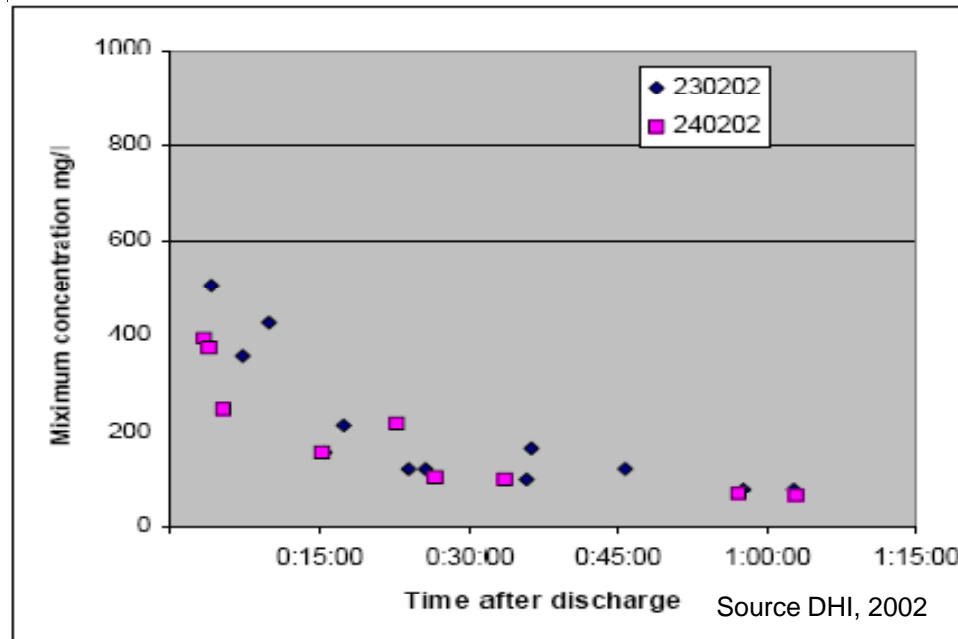




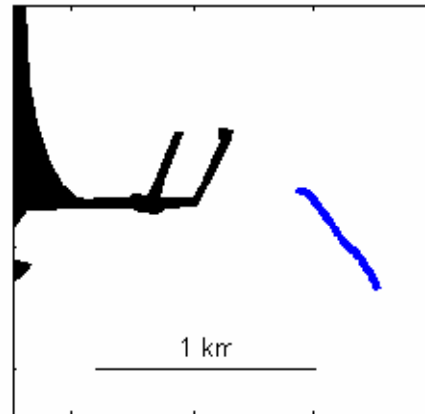
# RESULTS



Data



# RESULTS



## Experimento 1 Perfil 13

Hora inicial: 11 hr 38.4 min

Hora final: 11 hr 43.2 min

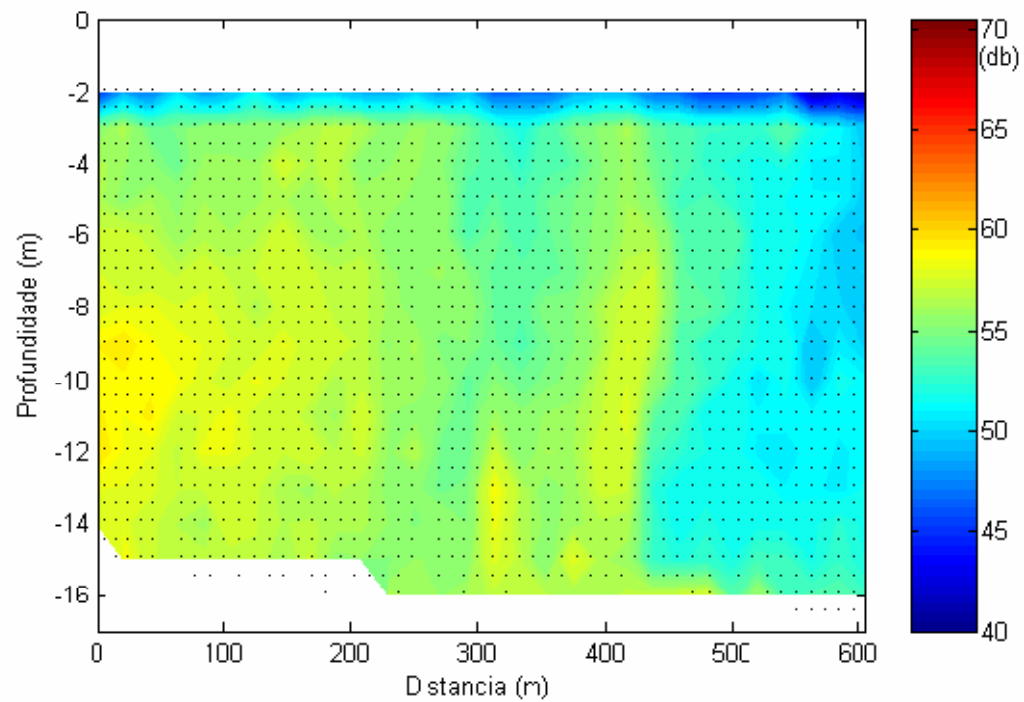
Latitude inicial: 20 gr 47.4 min (Sul)

Longitude inicial: 40 gr 33.6 min (Oeste)

Latitude final: 20 gr 47.4 min (Sul)

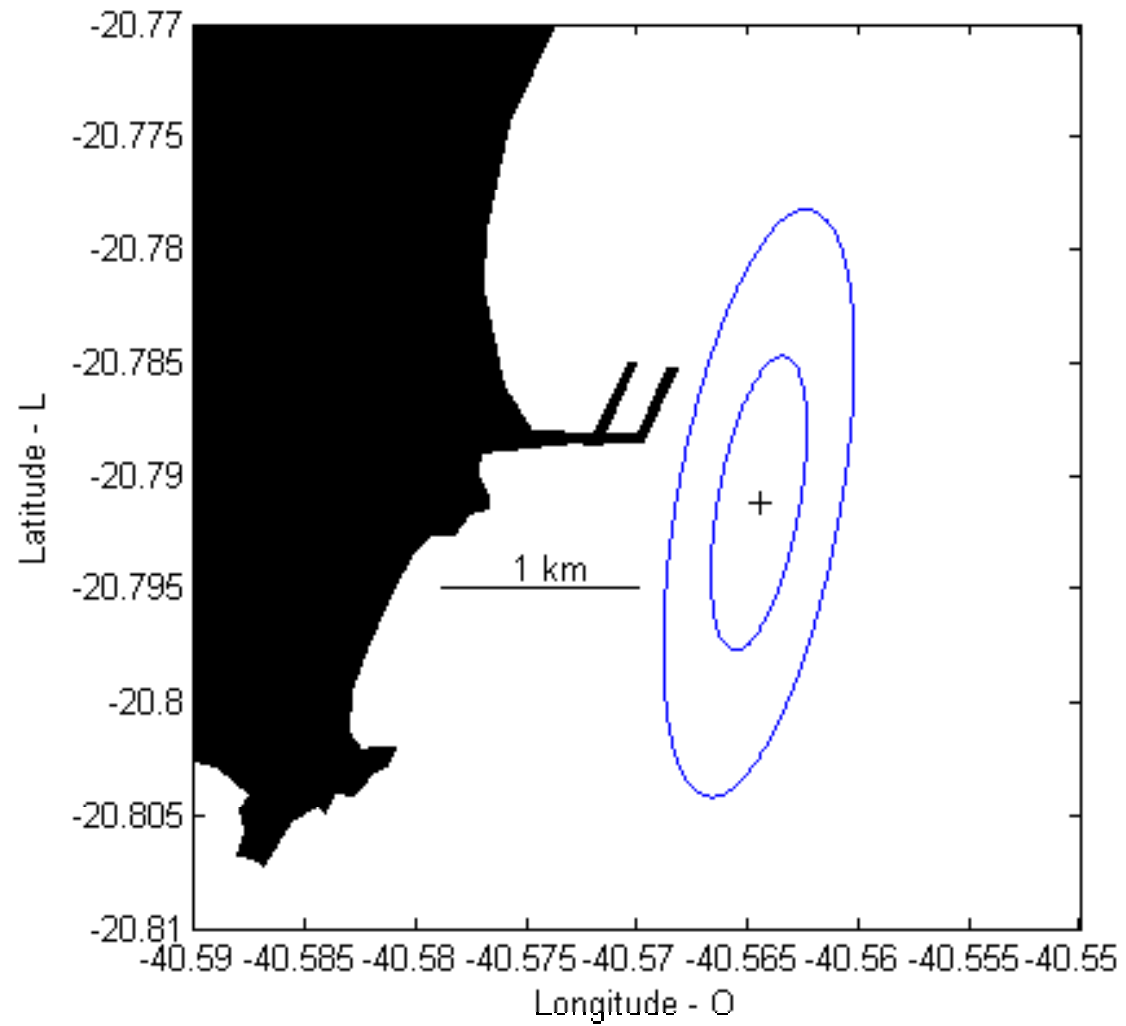
Longitude final: 40 gr 33.6 min (Oeste)

Distancia percorrida: 574 m





# RESULTS





*Parameters from field survey compared to earlier model simulations (Fonte: DHI)*

<b><i>Parameter at spoil-ground</i></b>	<b><i>Model</i></b>	<b><i>Field survey</i></b>
<i>Mean current velocity m/s</i>	<i>0.1-0.2</i>	<i>0.3-0.5</i>
<i>Current direction</i>	<i>Varying</i>	<i>230°-240°</i>
<i>Depth m</i>	<i>6-8</i>	<i>6-7</i>
<i>Total dumping volume m<sup>3</sup></i>	<i>continuos</i>	<i>600</i>
<i>Spill %</i>	<i>15</i>	<i>15</i>
<i>Volume of spill m<sup>3</sup></i>	<i>continuos</i>	<i>90</i>
<i>Settling velocity of material mm/s</i>	<i>0.05</i>	<i>0.15-0.9</i>
<i>Maximum length of the plume</i>	<i>8.4km</i>	<i>1.4km</i>





## CONCLUSIONS

- **Settling velocities measured in the field were much higher than originally estimated**
- **The model simulations based on theoretical assumptions tends to be conservative**
  - **This study was efficient to identify potencial areas impacted to the disposal dredge material.**
- **It is important to establish the strategies to control the dredge activities and monitoring the enviromental impacts.**





**OBRIGADO !**

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