

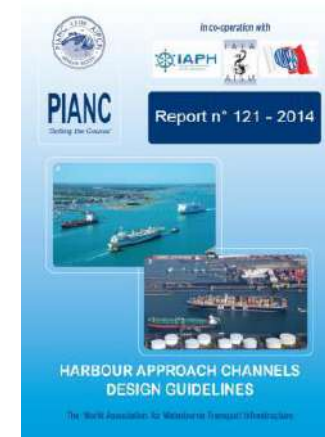
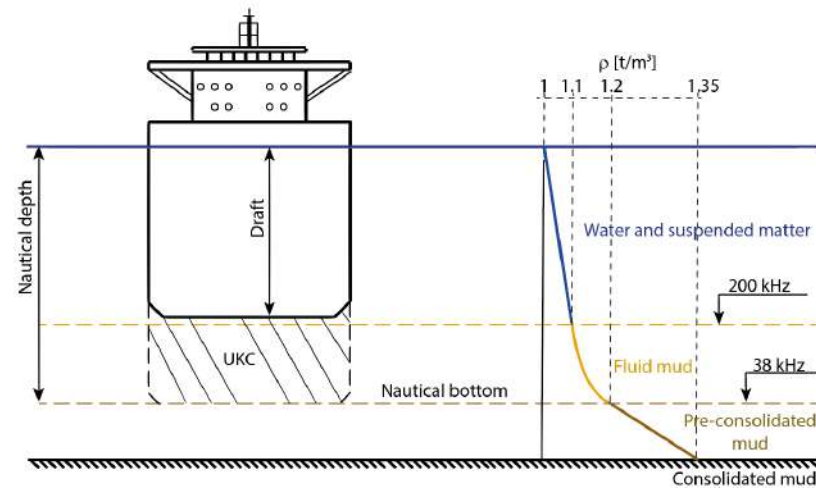
# Testing Conditioning Methods for Maintenance Dredging in Ports

Alex Kirichek, A. Bampatzeliou, J. Gebert,  
C. Chassagne (all - TU Delft)  
N. Ohle, U. Schmekel (both - HPA)

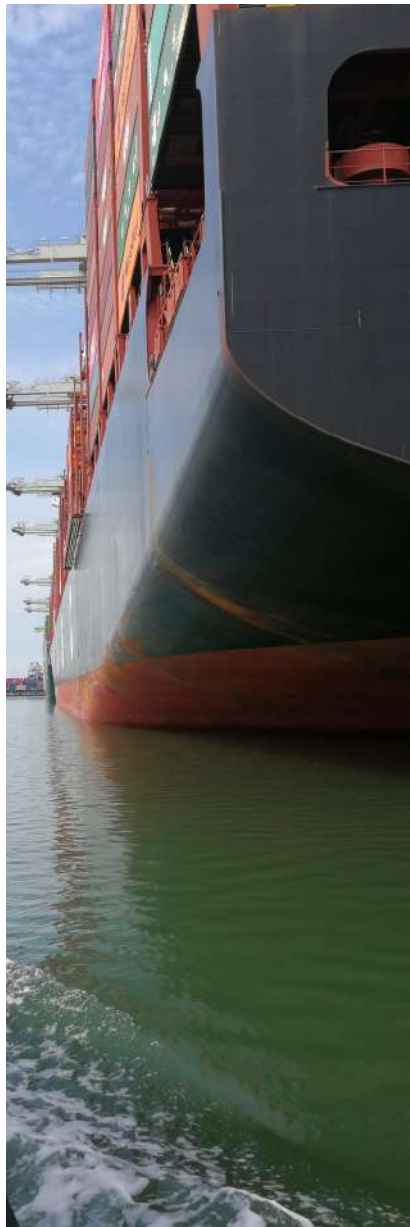




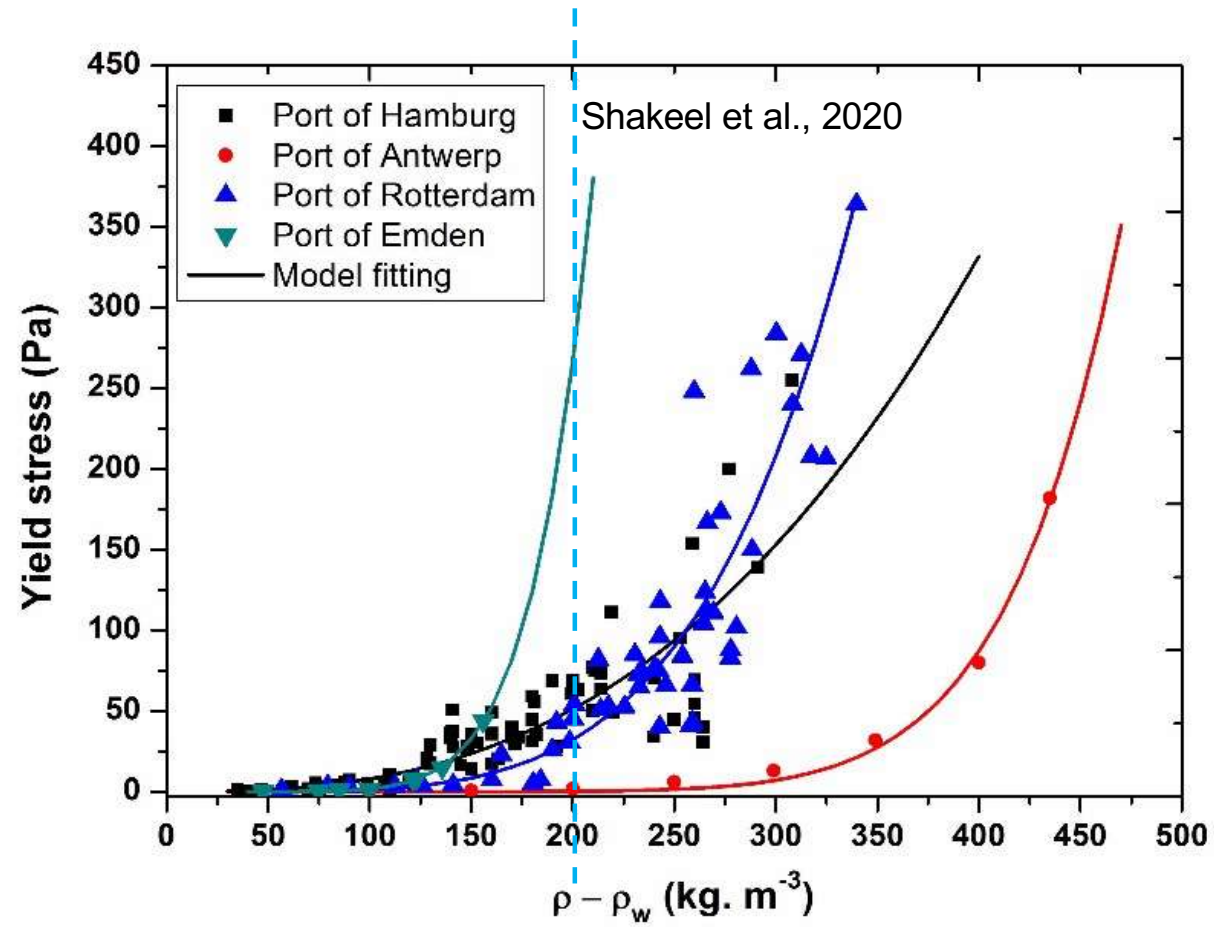
# Nautical bottom



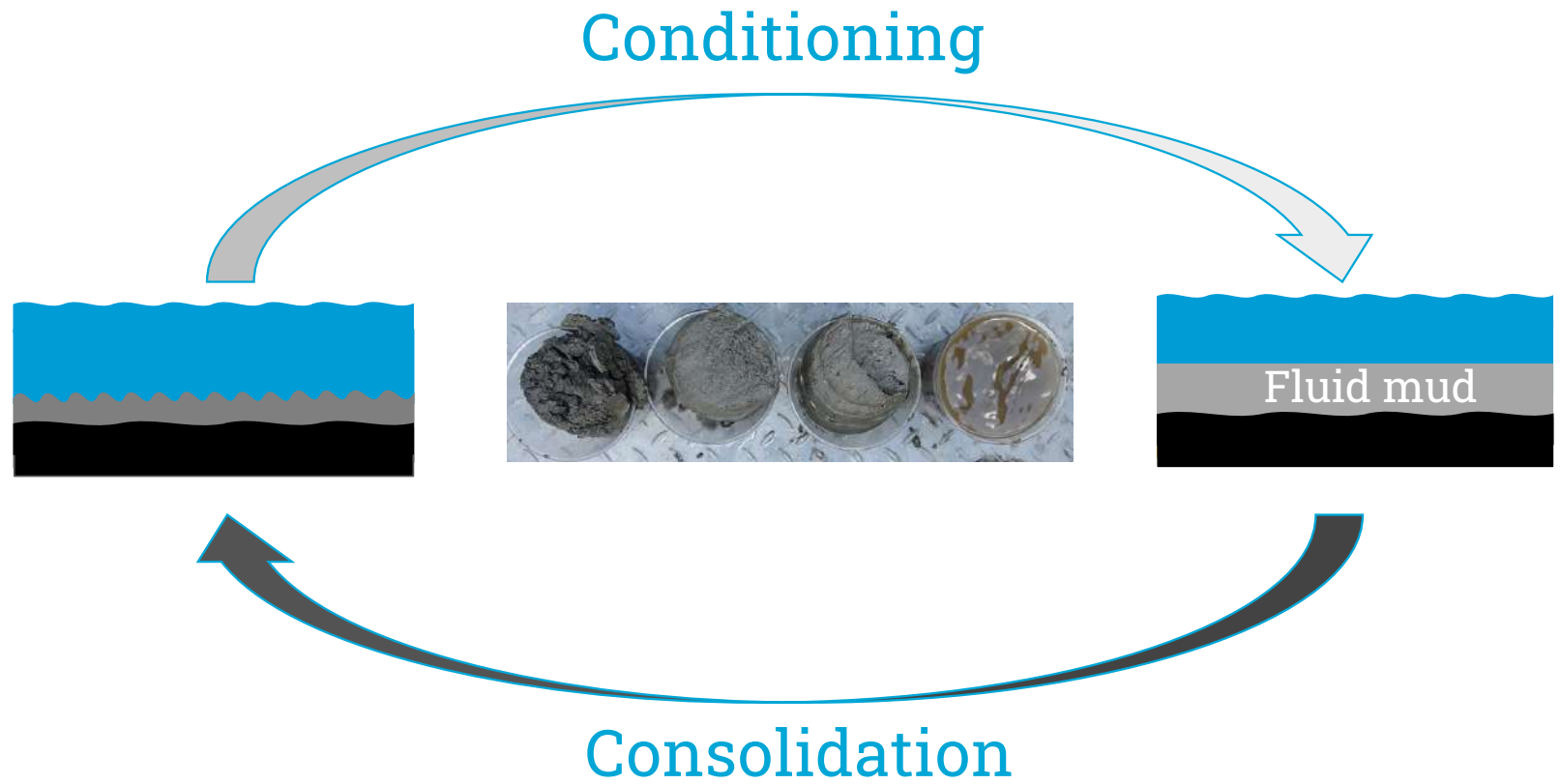
Port	country	critierion	value	dimension
Rotterdam	the Netherlands	density	1200	kg/m <sup>3</sup>
Zeebrugge	Belgium	density	1200	kg/m <sup>3</sup>
Bordeaux	France	density	1200	kg/m <sup>3</sup>
Nantes-Saint Nazaire	France	density	1200	kg/m <sup>3</sup>
Bristol	the UK	density	1200	kg/m <sup>3</sup>
Emden	Germany	yield stress	50-100	Pa
Hamburg	Germany	yield stress, density	50-70 1150	Pa kg/m <sup>3</sup>



## Nautical bottom



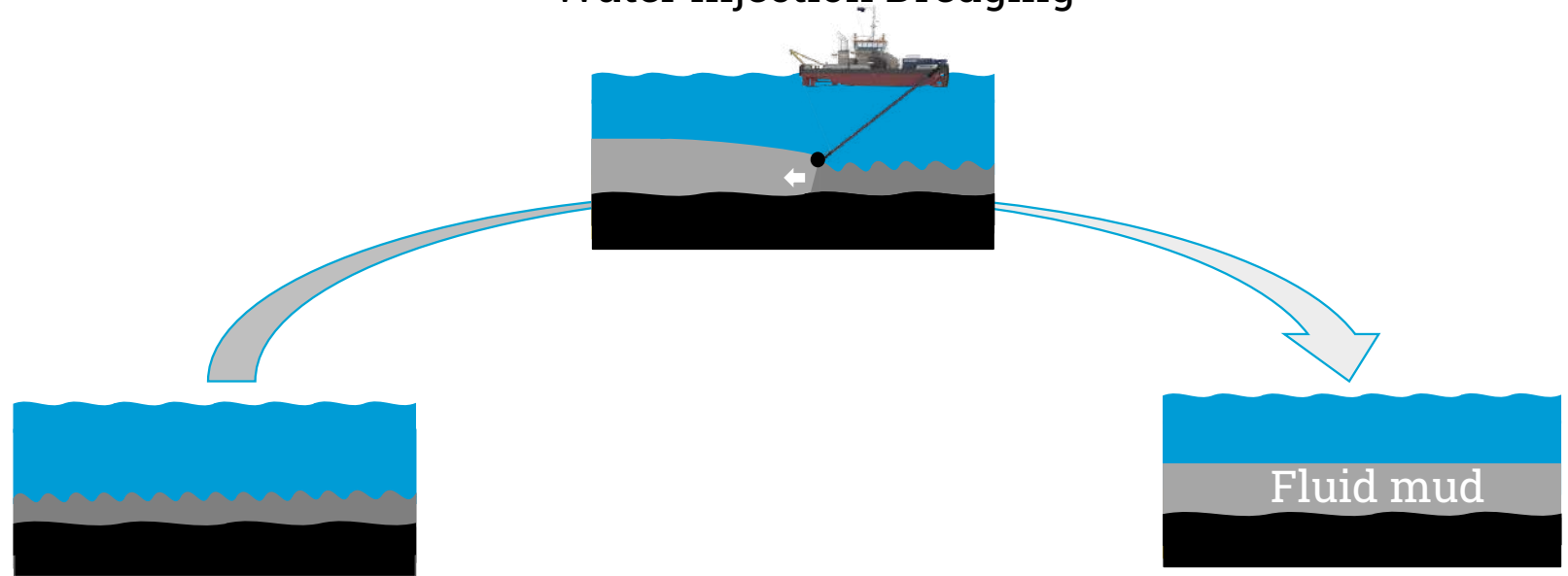
# Conditioning methods





# Conditioning methods

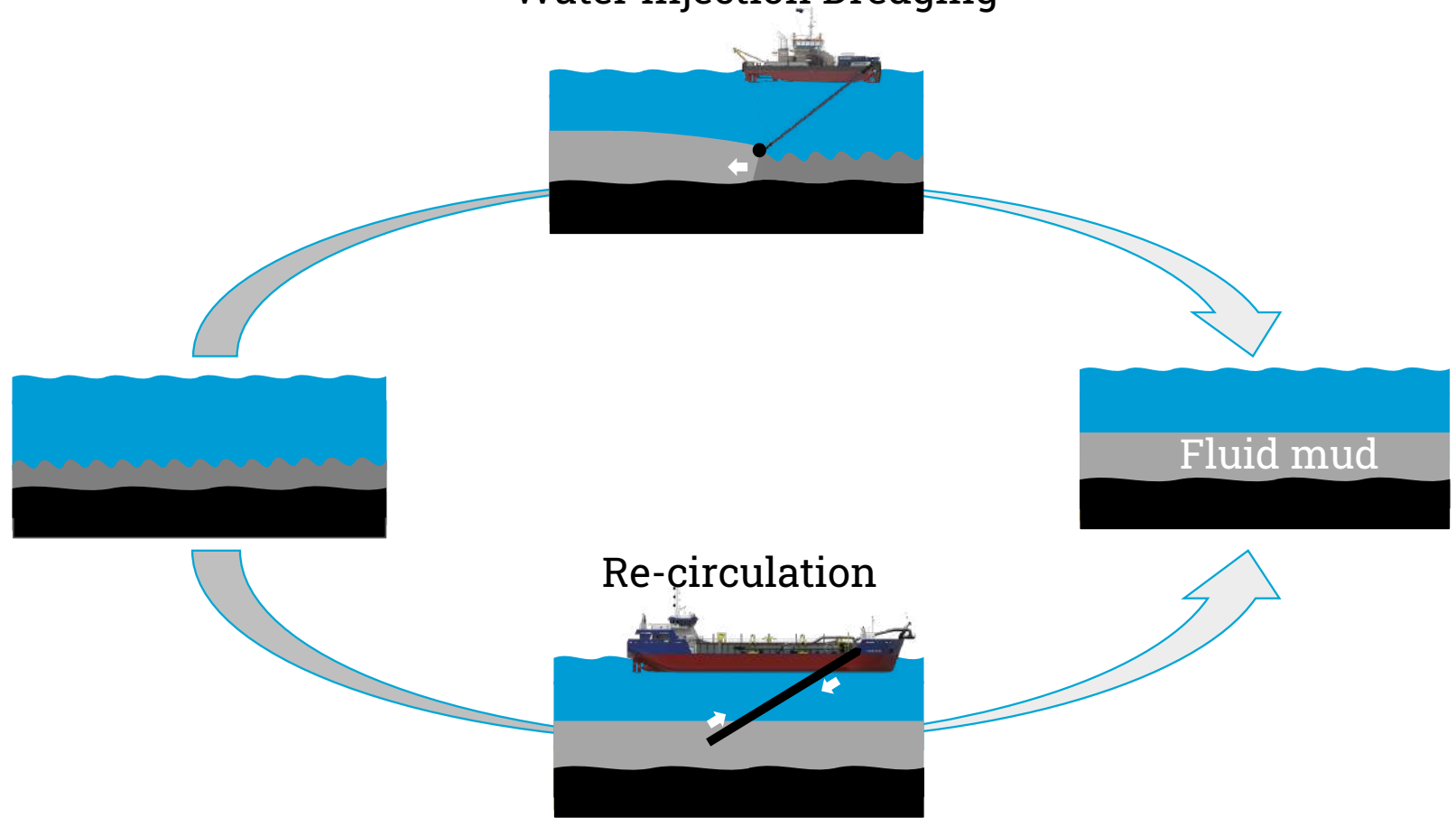
## Water Injection Dredging





# Conditioning methods

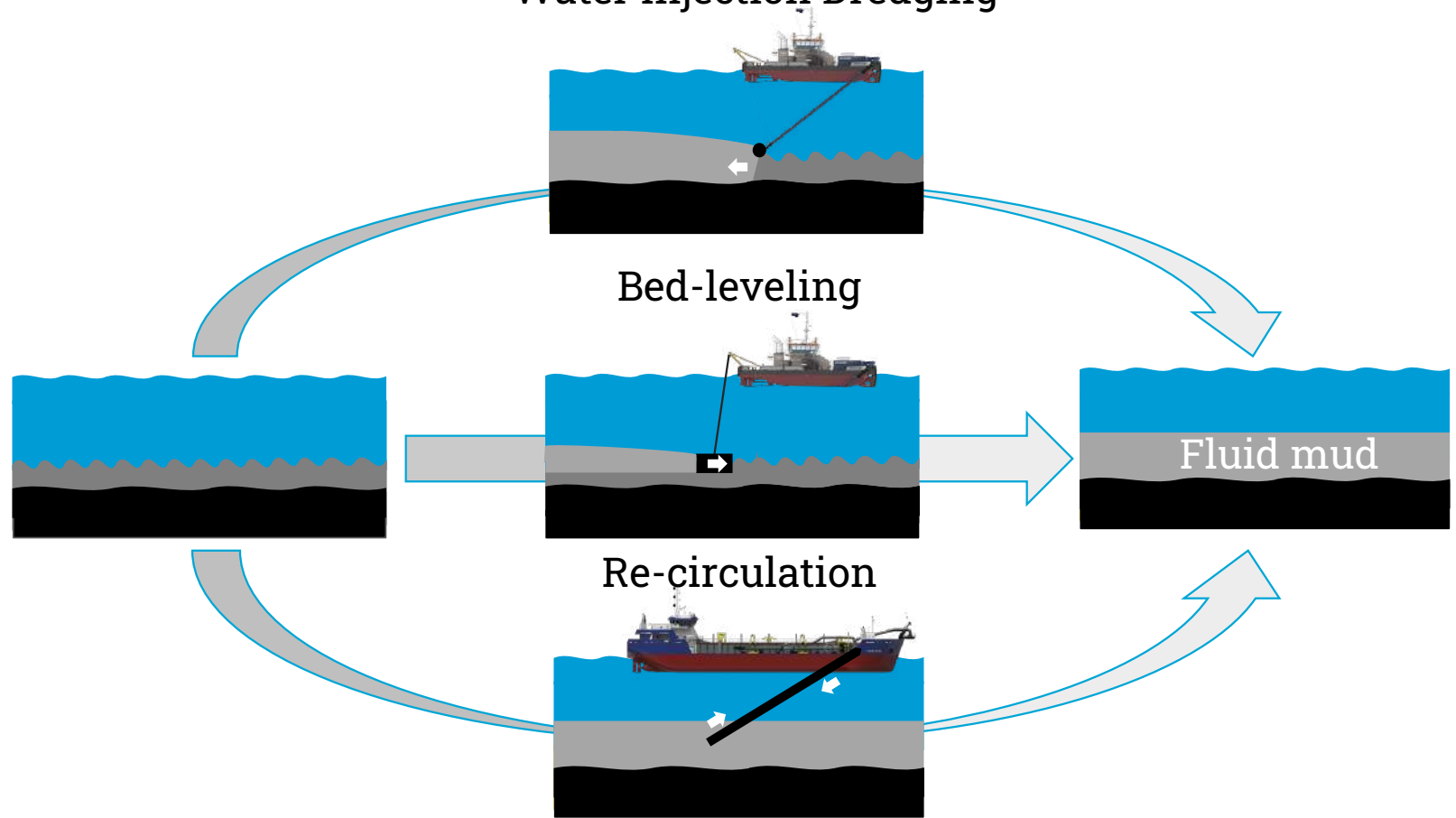
## Water Injection Dredging





# Conditioning methods

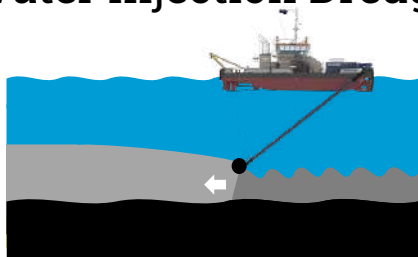
## Water Injection Dredging



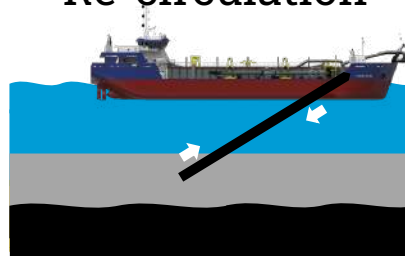
## Conditioning methods

- What are the optimal conditions for using the methods?
- What is the environmental impact of the methods?

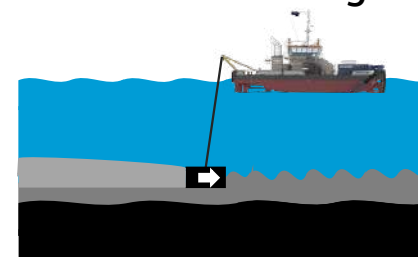
Water Injection Dredging



Re-circulation



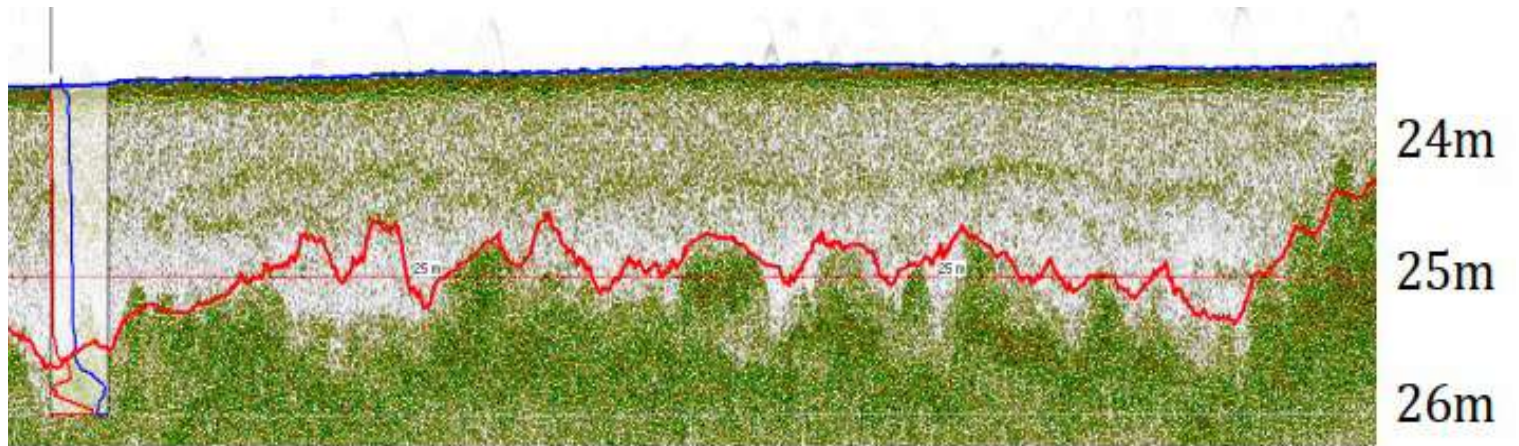
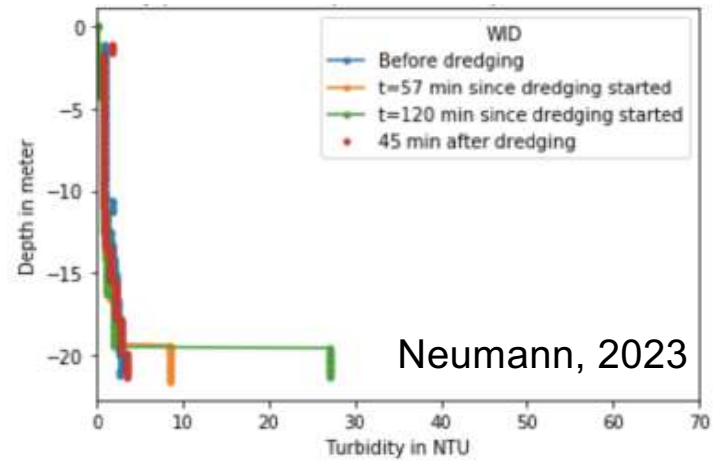
Bed-leveling



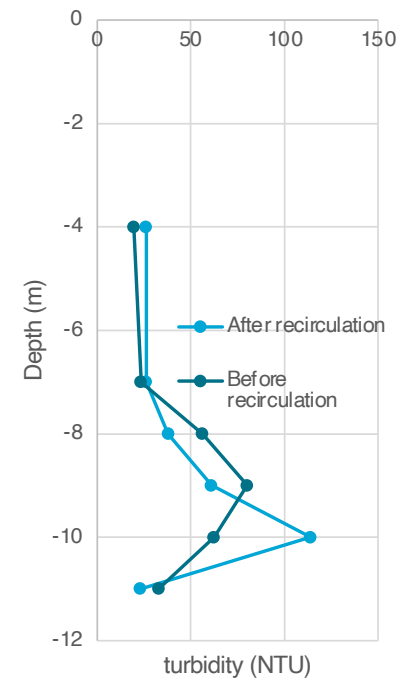
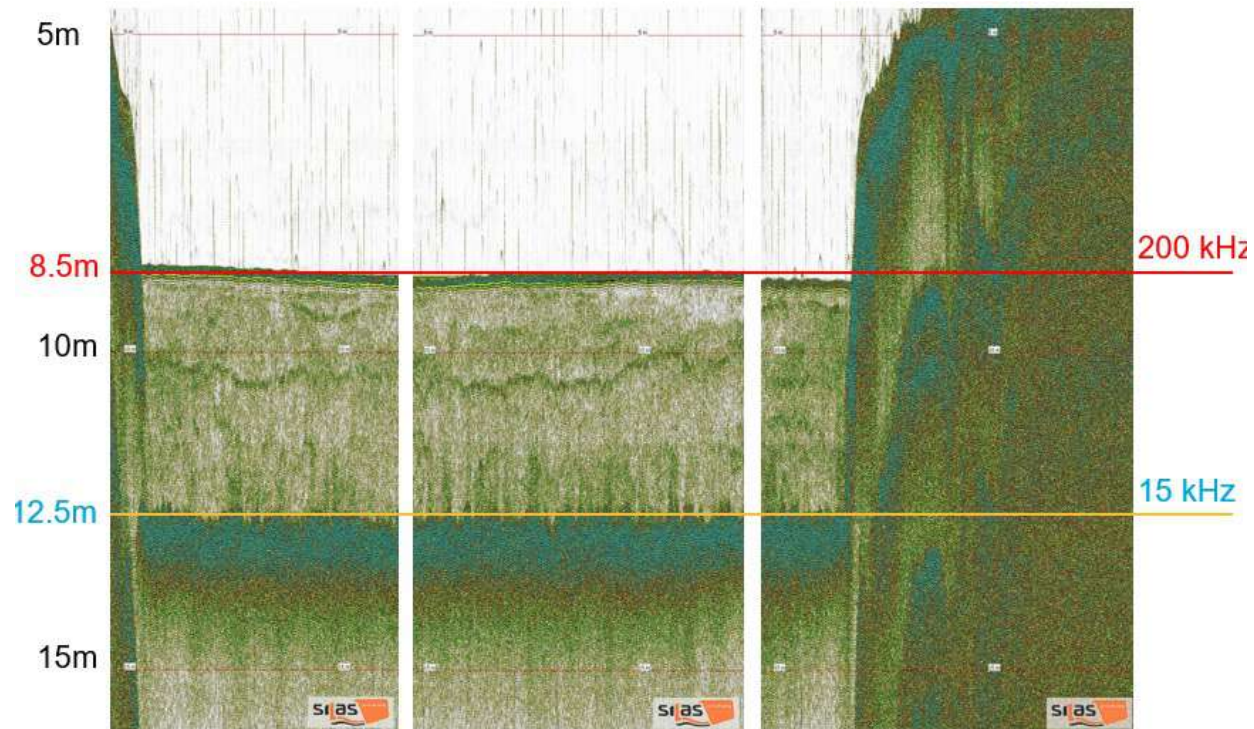




## Field trials: WID

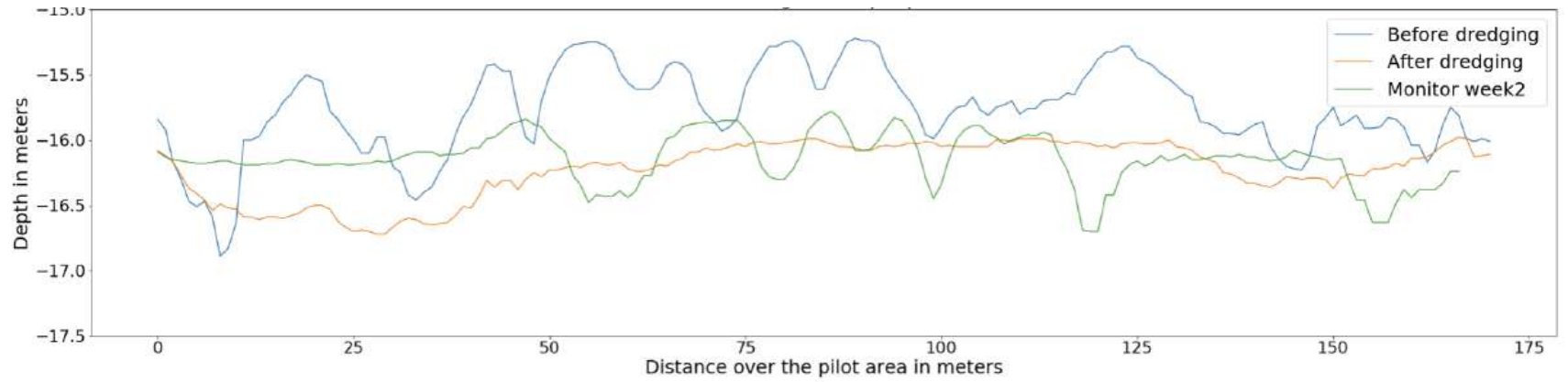
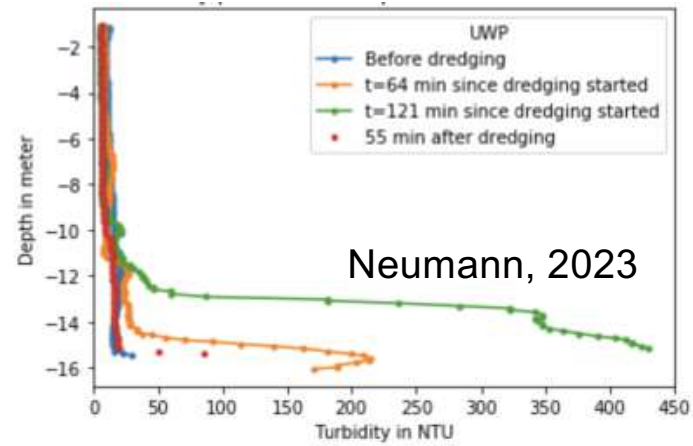


# Field trials: Re-circulation





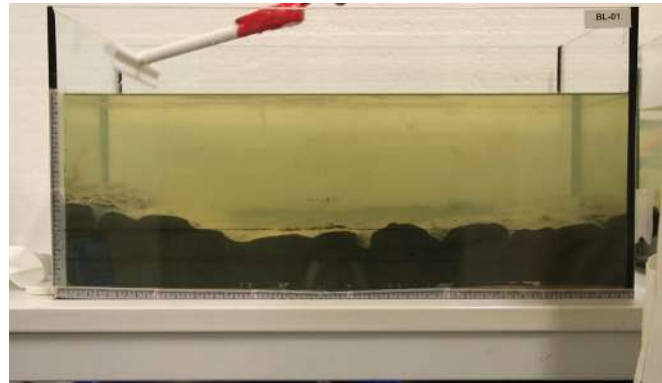
## Field trials: Bed levelling



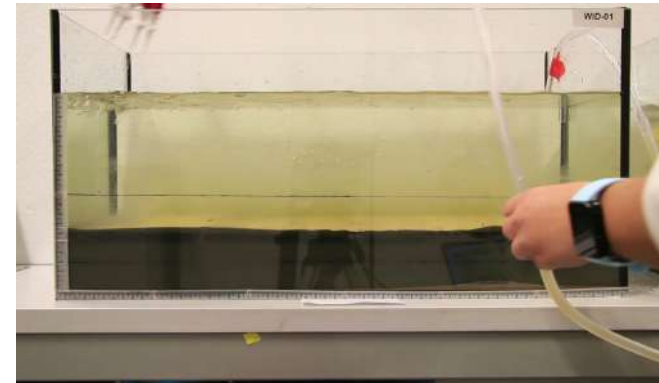


## Lab research

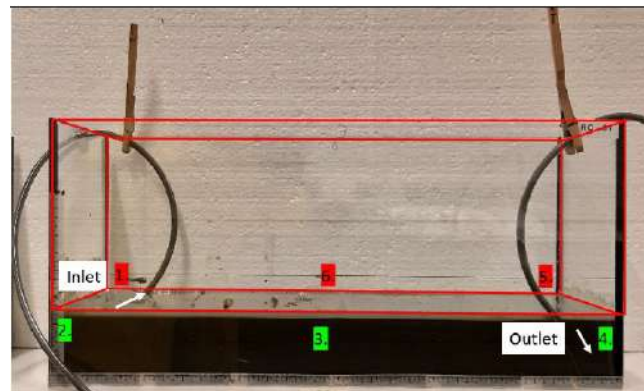
Bed leveling



Water injection dredging



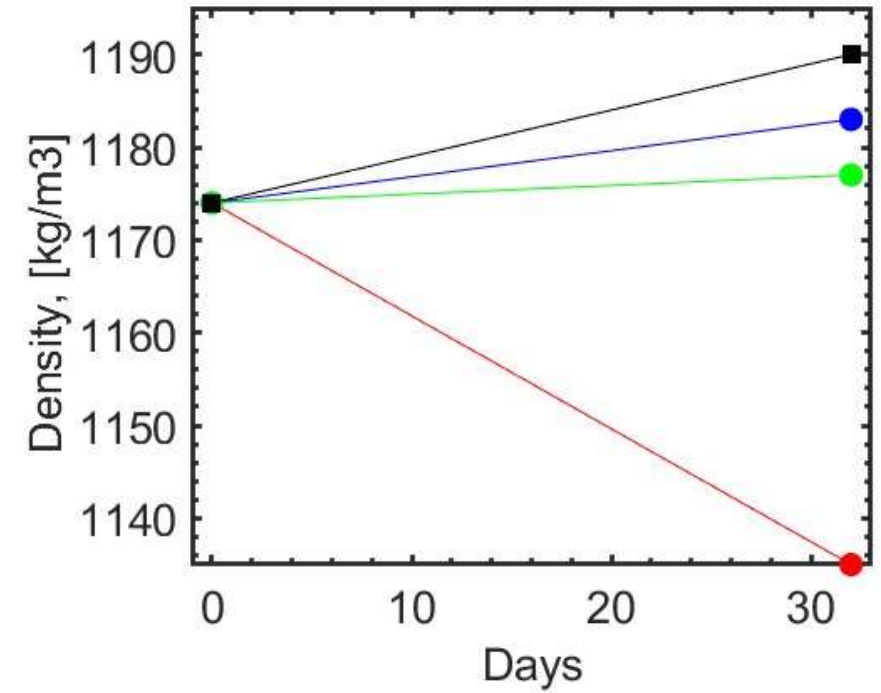
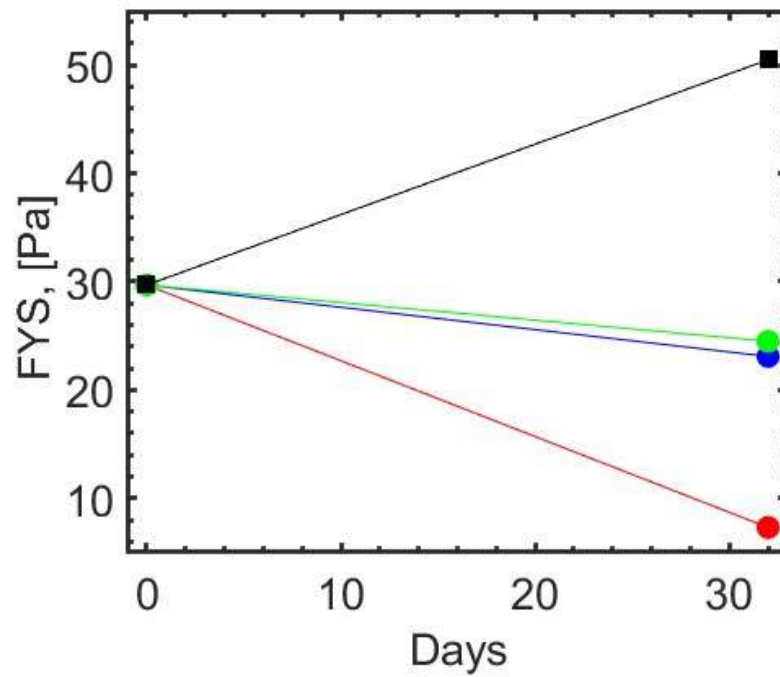
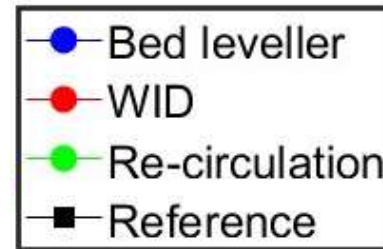
Re-circulation



## Lab research

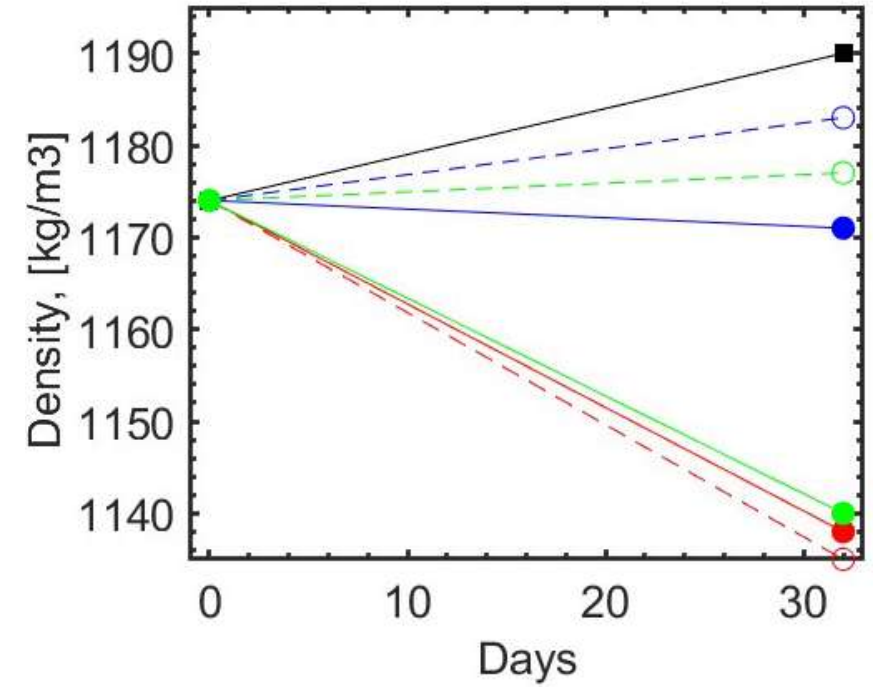
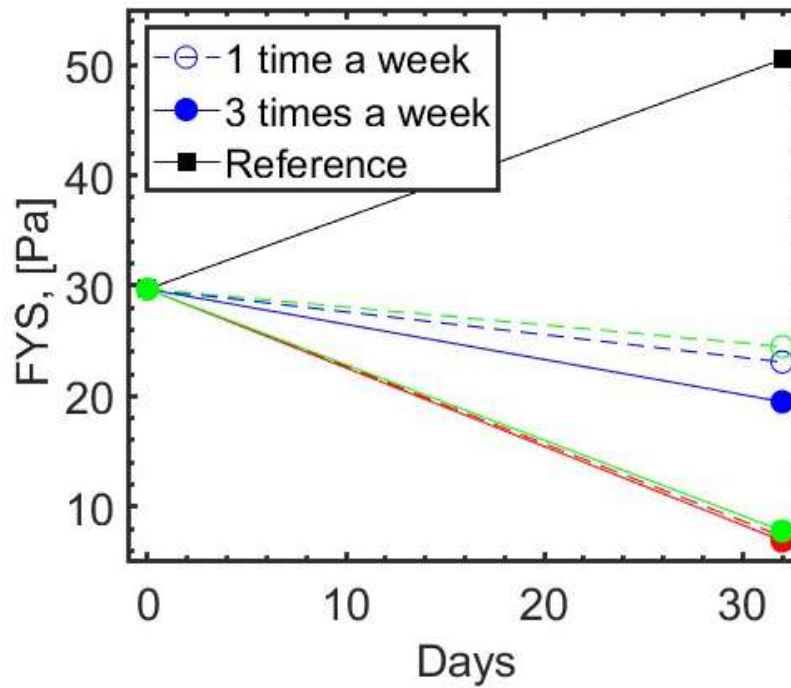
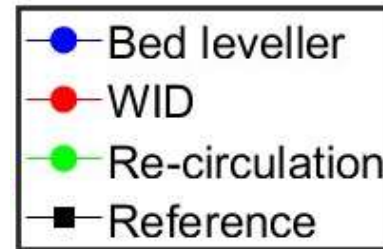


## Lab research: effect of conditioning methods

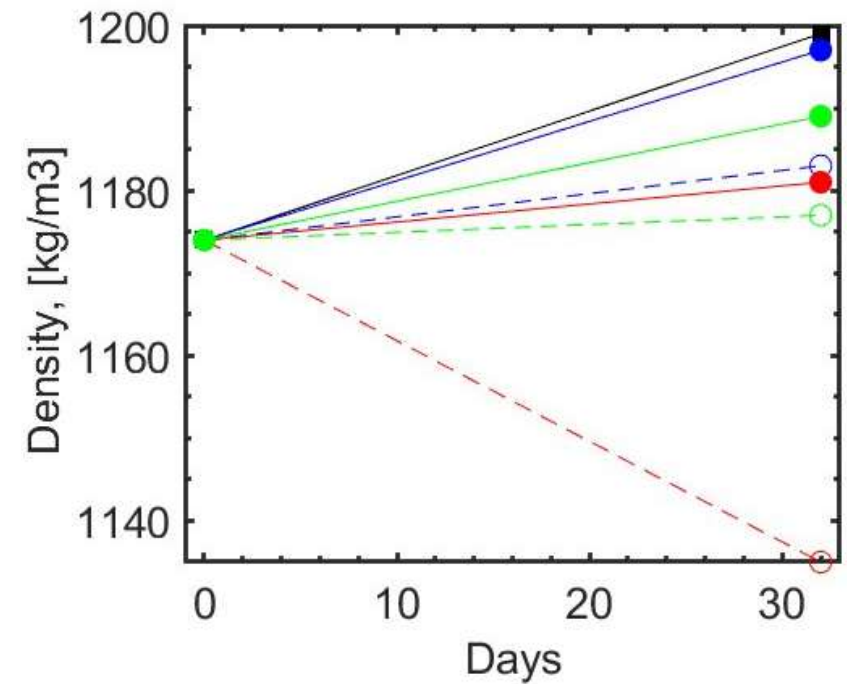
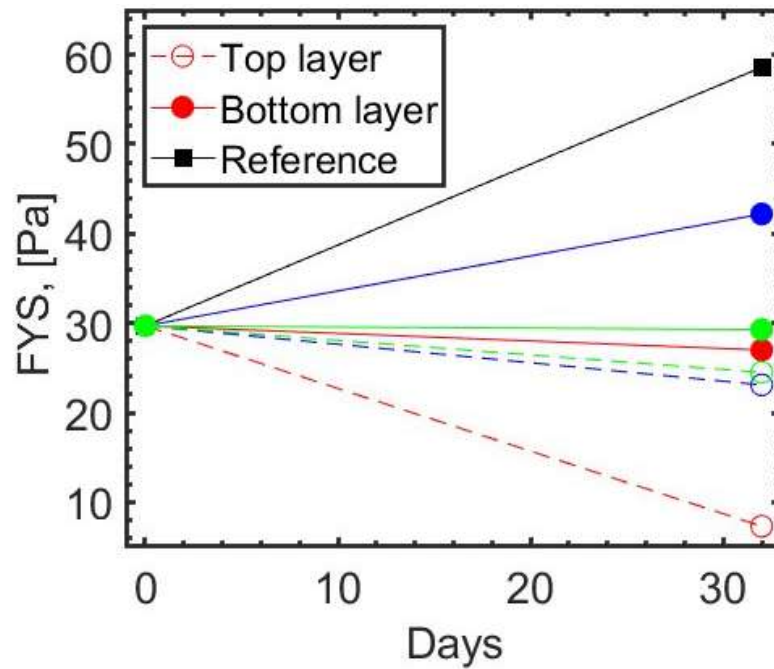
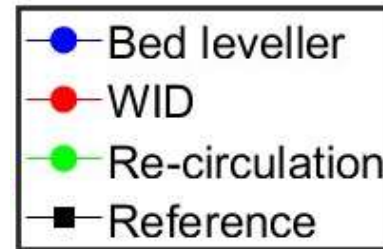
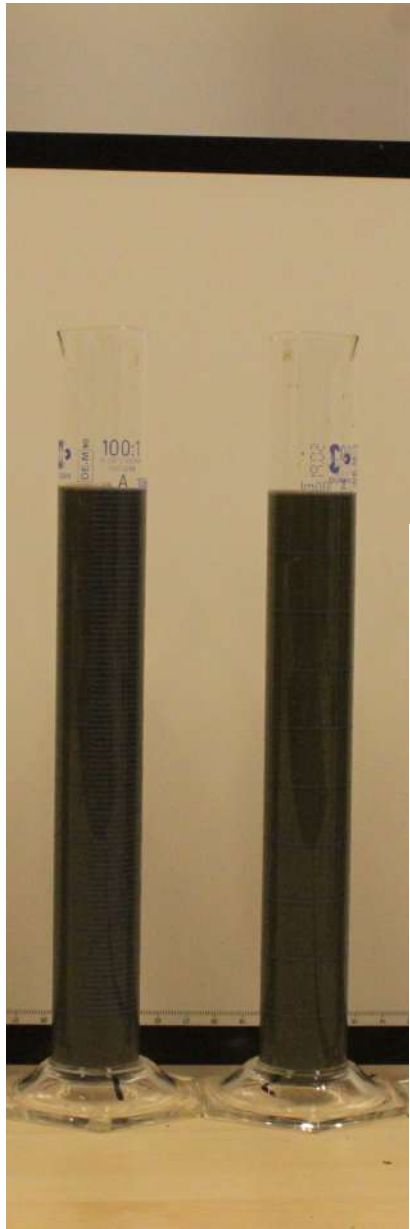




## Lab research: effect of maintenance frequency

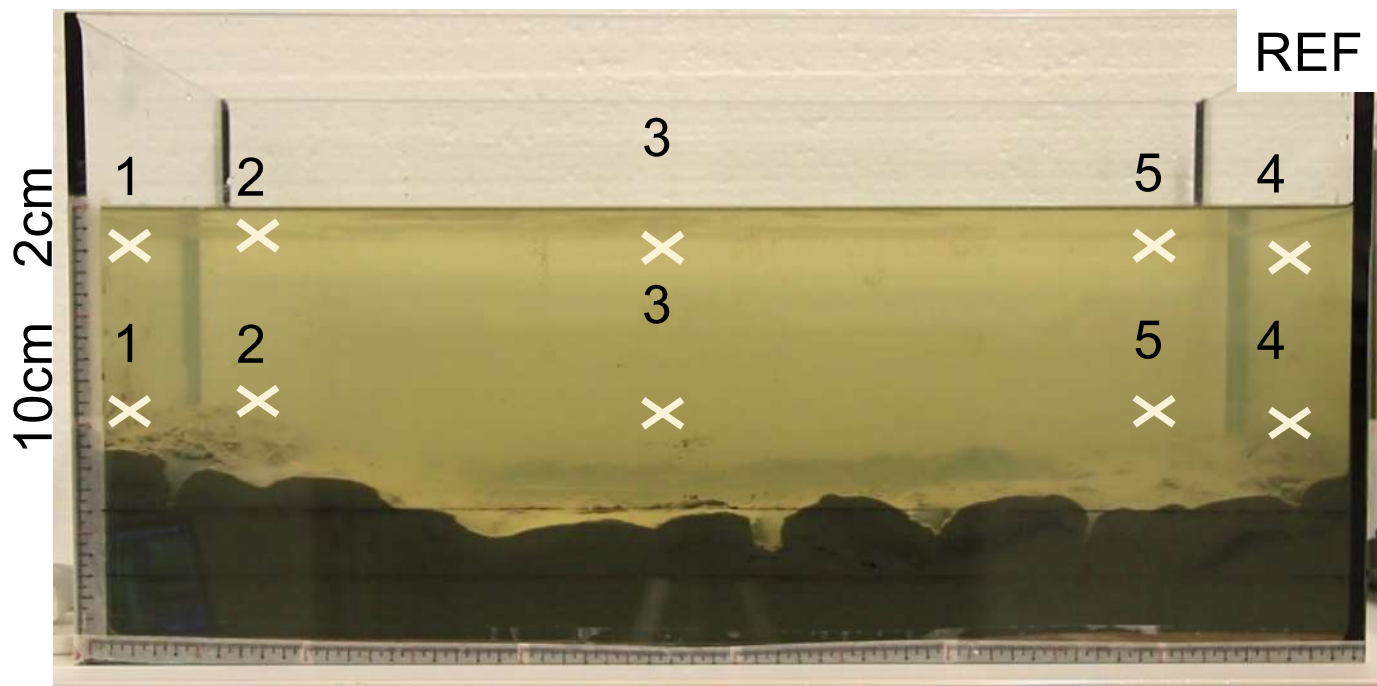


## Lab research: effect on mud layers





# Lab research: O<sub>2</sub>



10cm  
2cm

1

X

2

X

3

X

3

X

5

X

5

X

REF

4

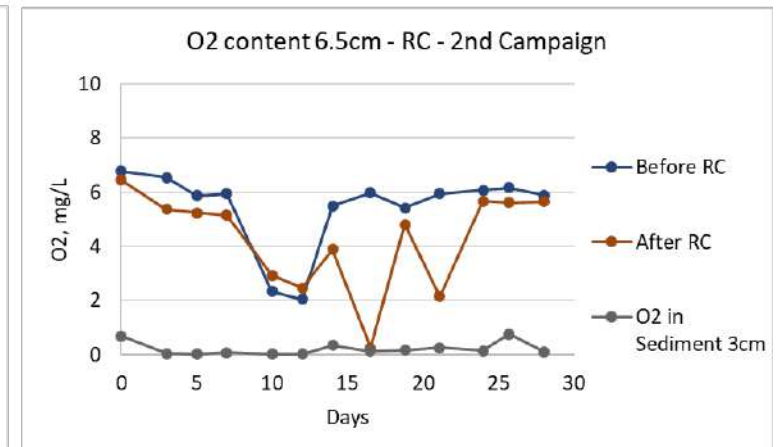
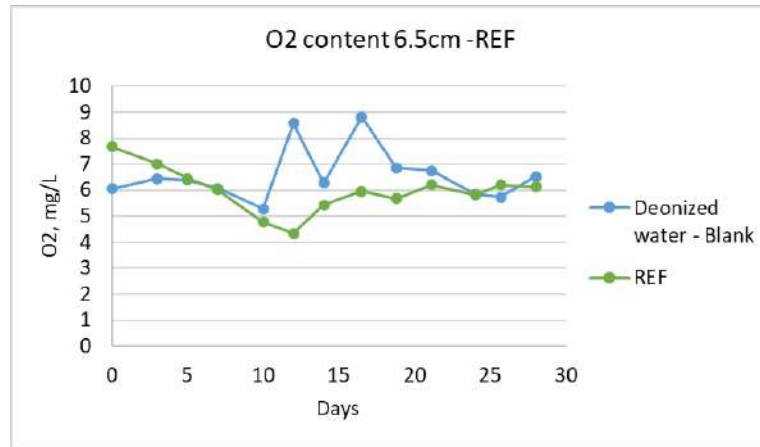
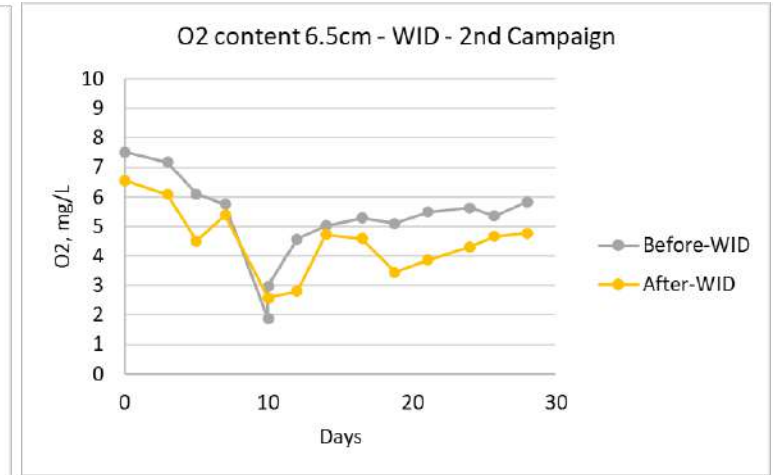
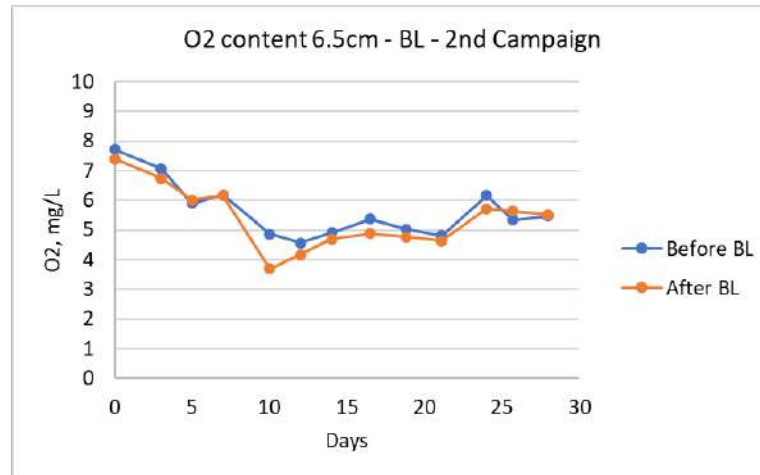
X

4

X



## Lab research: O<sub>2</sub>



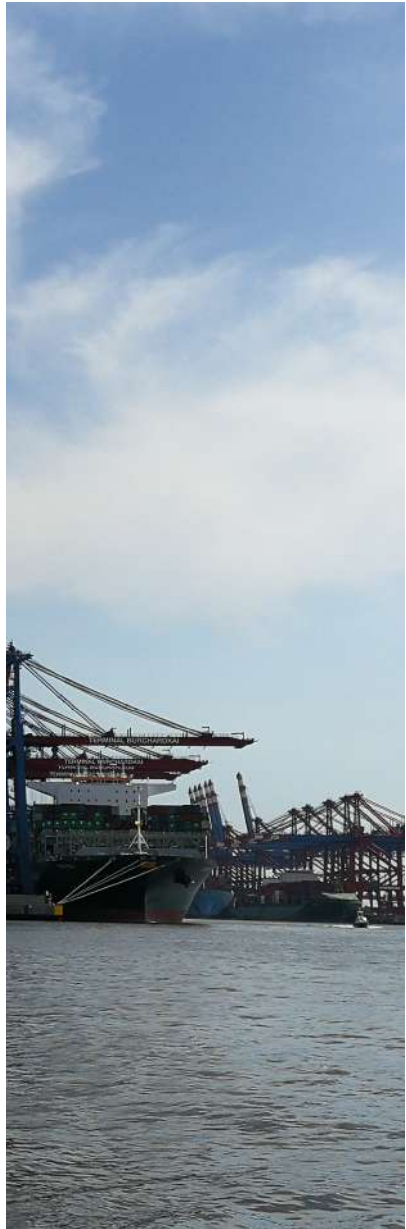
## Conclusions

- Water Injection Dredging, Re-circulation and Bed Leveling can be used for sediment conditioning
- Density and yield stress of fluid mud are affected by the frequency of maintenance
- Oxygen saturation in the water column is less affected by bed leveling than by WID and RC.
- Dredging-induced turbidity in the water column recovers quickly to the values of natural turbidity



# Acknowledgement

# MUDNET



Thank you for your attention