Risk assessment & management of polluted sediments in areas with a nautical necessity

A case study from the Port of Antwerp, Belgium

November 2013

Port of Antwerp

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1 Introduction on the specific port situation

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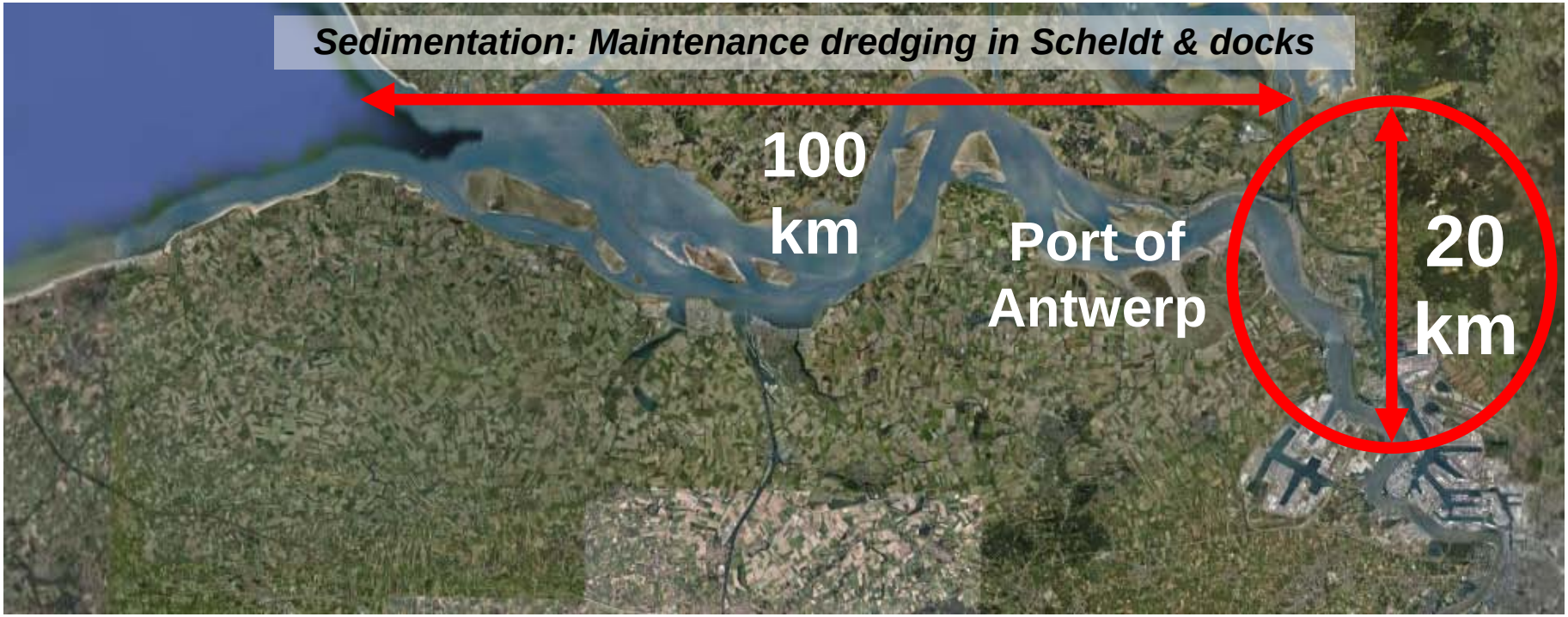

Scheldt River + Tidal Docks, cays on Scheldt river (1999 – 2008): 12.5 million m^3/y

→92 % of dredged material stays in Scheldt estuary
→8% (sand) is used for different applications

Introduction on the specific port situation

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Classic port activities:

- storage and transshipment
- petro chemistry
- container terminals
- 2 shipyards

2 Environmental sustainable policy on TBT

Environmental sustainable policy on TBT

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2.1 Research on BATNEEC

2.2 Port Regulation

2.3 Monitoring program

2.1 Research on BATNEEC techniques

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2005: program leader of TBT CLEAN (Life-environment program) with as main objective the development of an integrated approach for the removal of tributyltin from waterways and ports

2013: cluster on innovating shipyard techniques with stakeholders and support of Flemish government

2.2 Port Regulation on environment friendly anti-fouling

2.3 Intensive monitoring program on sediment quality

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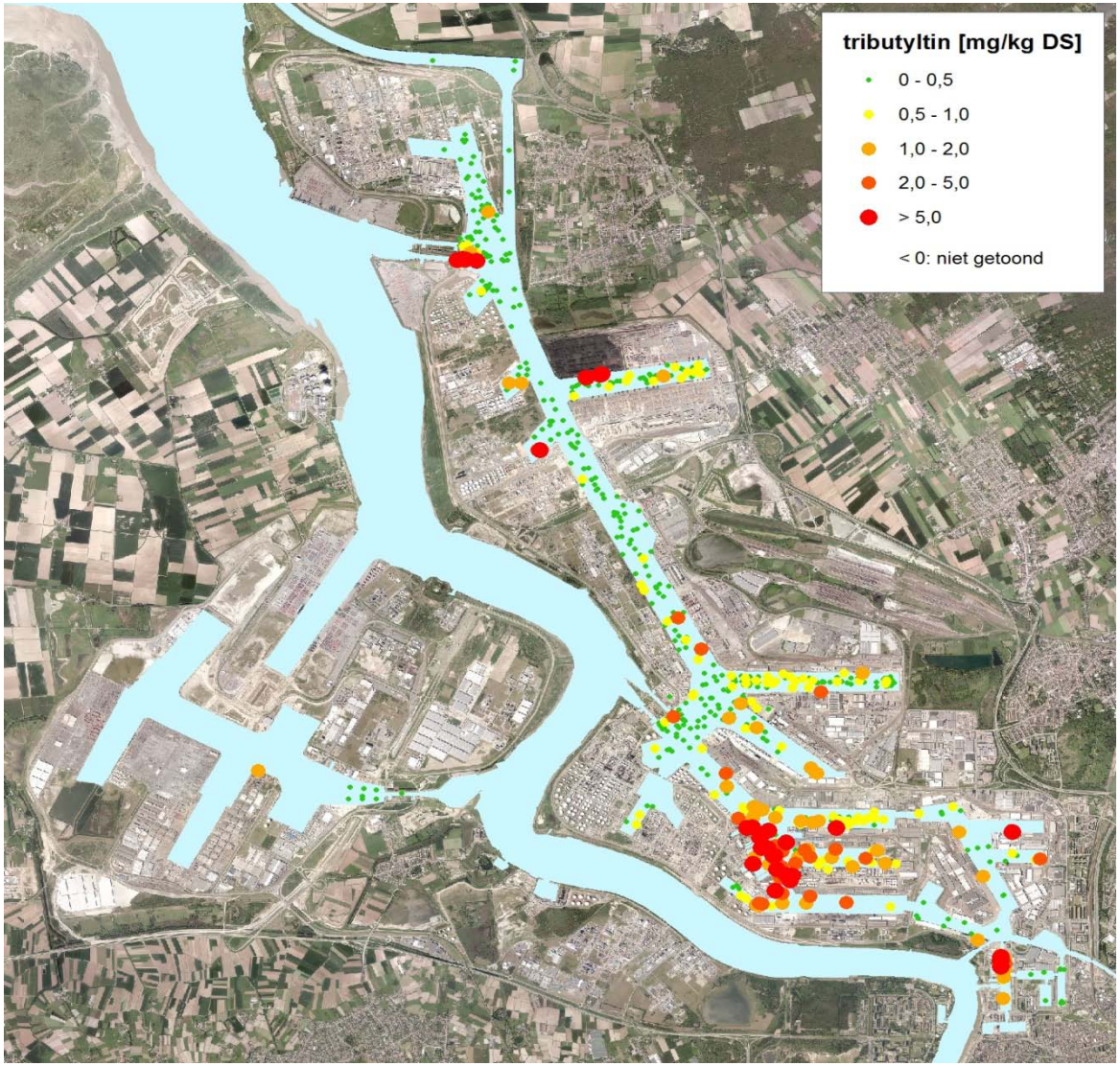
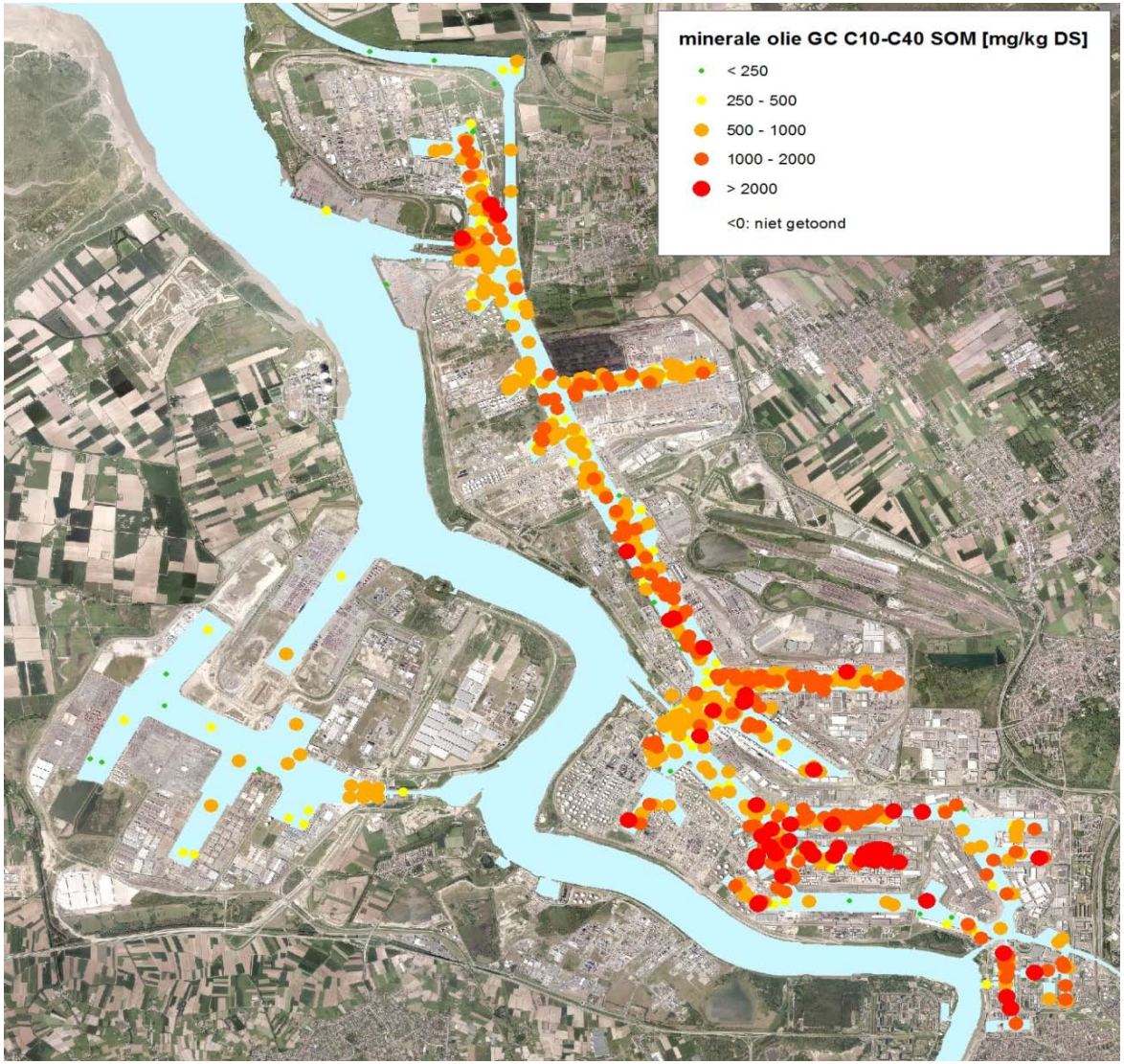


2.3 Intensive monitoring program on sediment quality



3 Case study risk assessment

Case study: case study risk assessment

3.1 Study area

3.2 Dredging works

3.3 Pollution

3.4 Project objectives

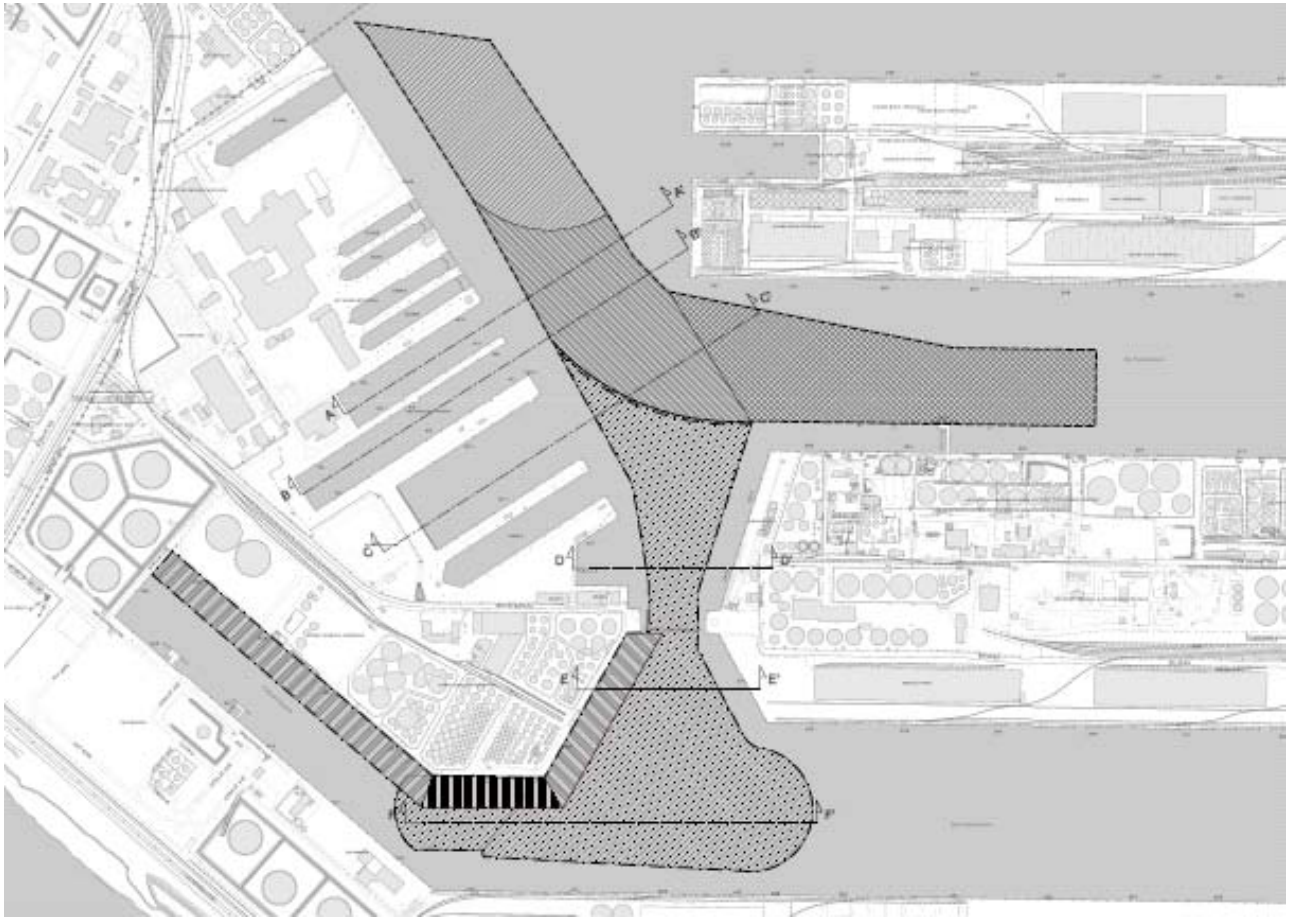
3.5 Results

3.1 Study area:
Port of Antwerp – Right Bank – Hansa Dock

Historical presence of Shipyards

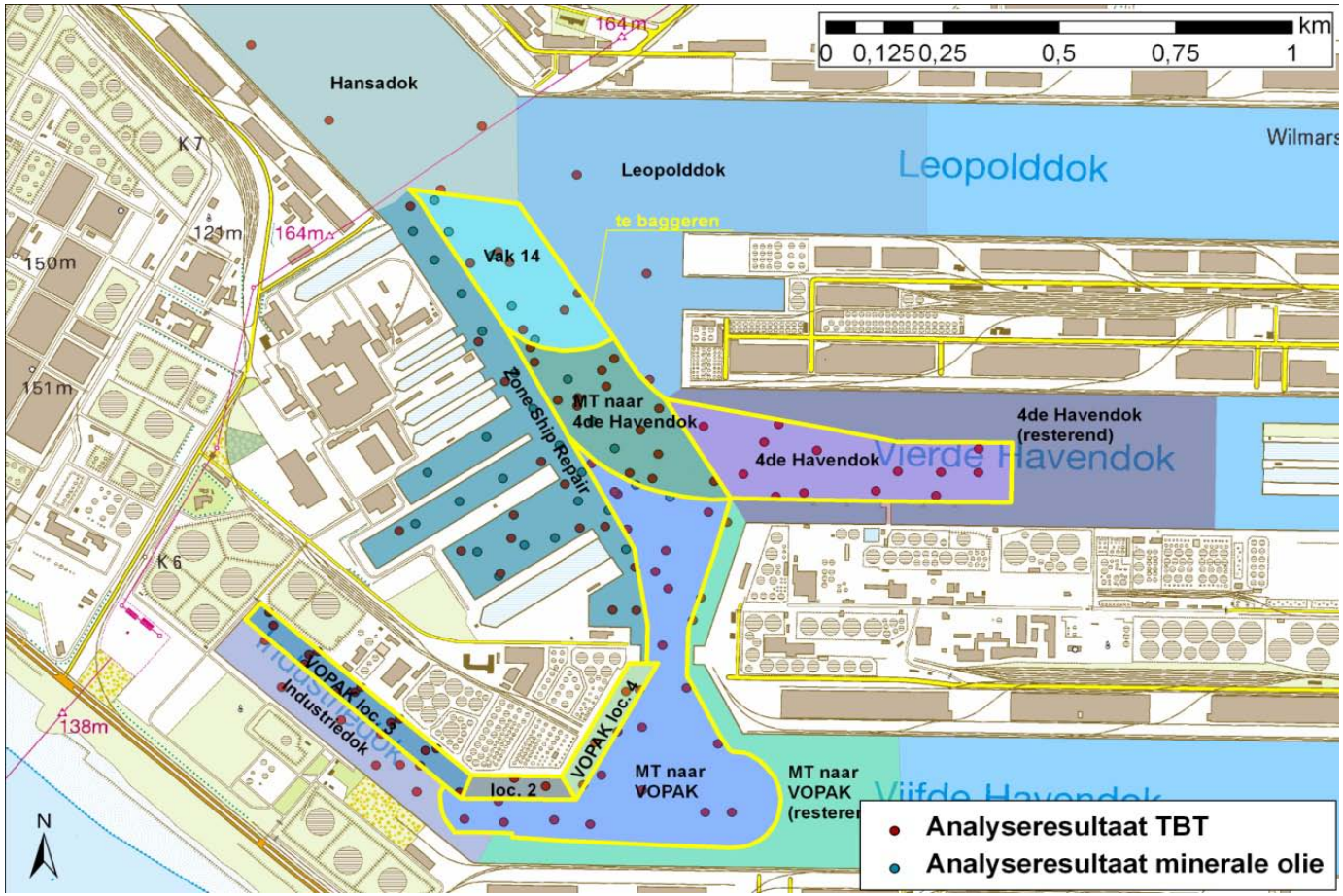
3.2 *Dredging works*

Maintenance and nautical dredging works: volume of 700.000 m³ sediment



3.3 Pollution

Study area: previous surveys



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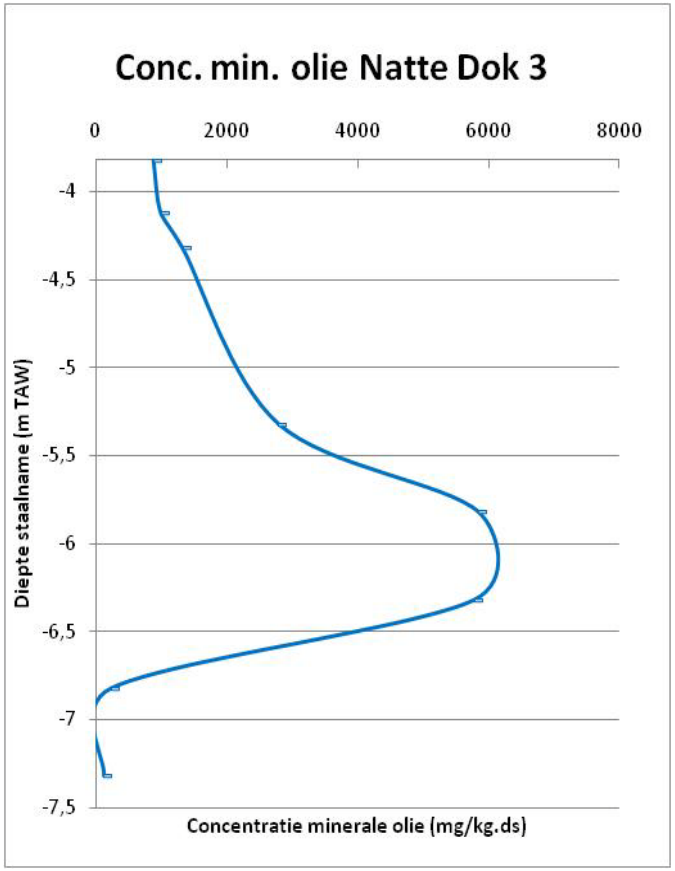
3.3 Pollution

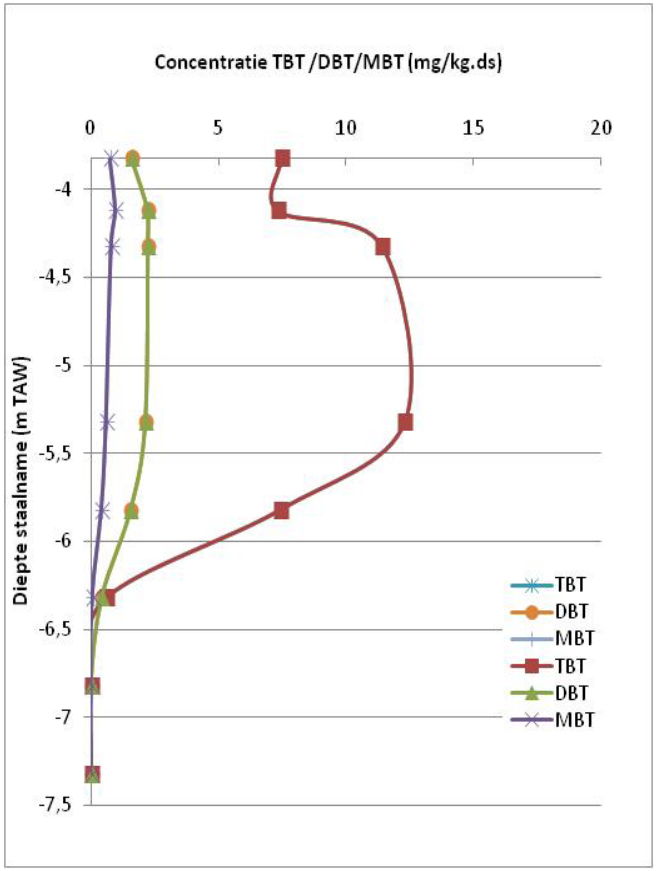
Synthesis present data:

- Project area for dredging works is polluted with heavy metals (Cu, Pb), mineral oil (MO), tributyltin (TBT), PCBs and naphtalene.
- The pollution with MO and TBT exceeds the scope of the dredging works by 200% (horizontally and vertically).
- No spreading from pollution on landside.
- Because of a remarkable gradient in concentration of MO and TBT in the docks, some additional samples and analysis were executed.

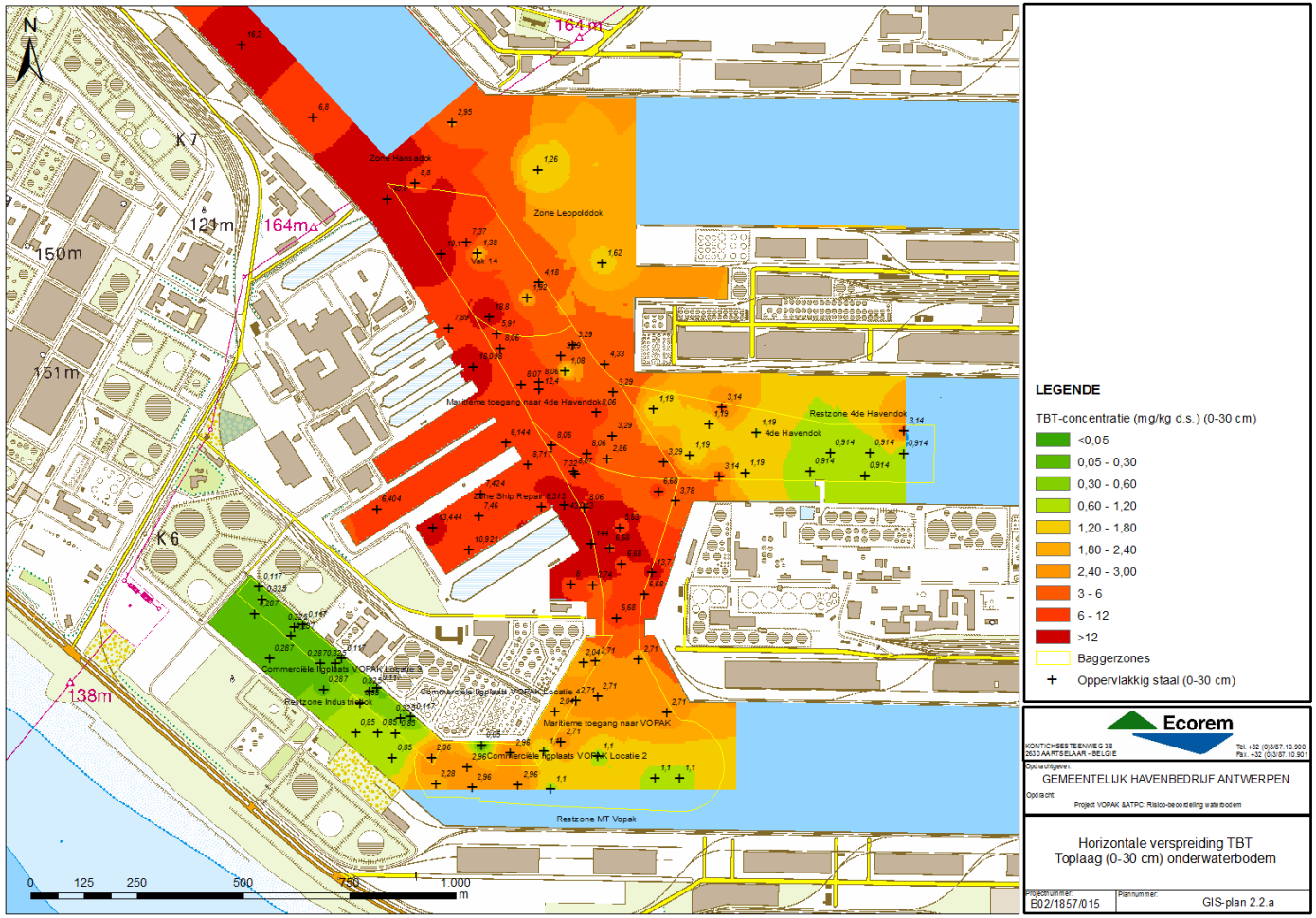
3.3 Pollution

Gradient in concentration of TBT and MO:





3.3 Pollution:
TBT before dredging works



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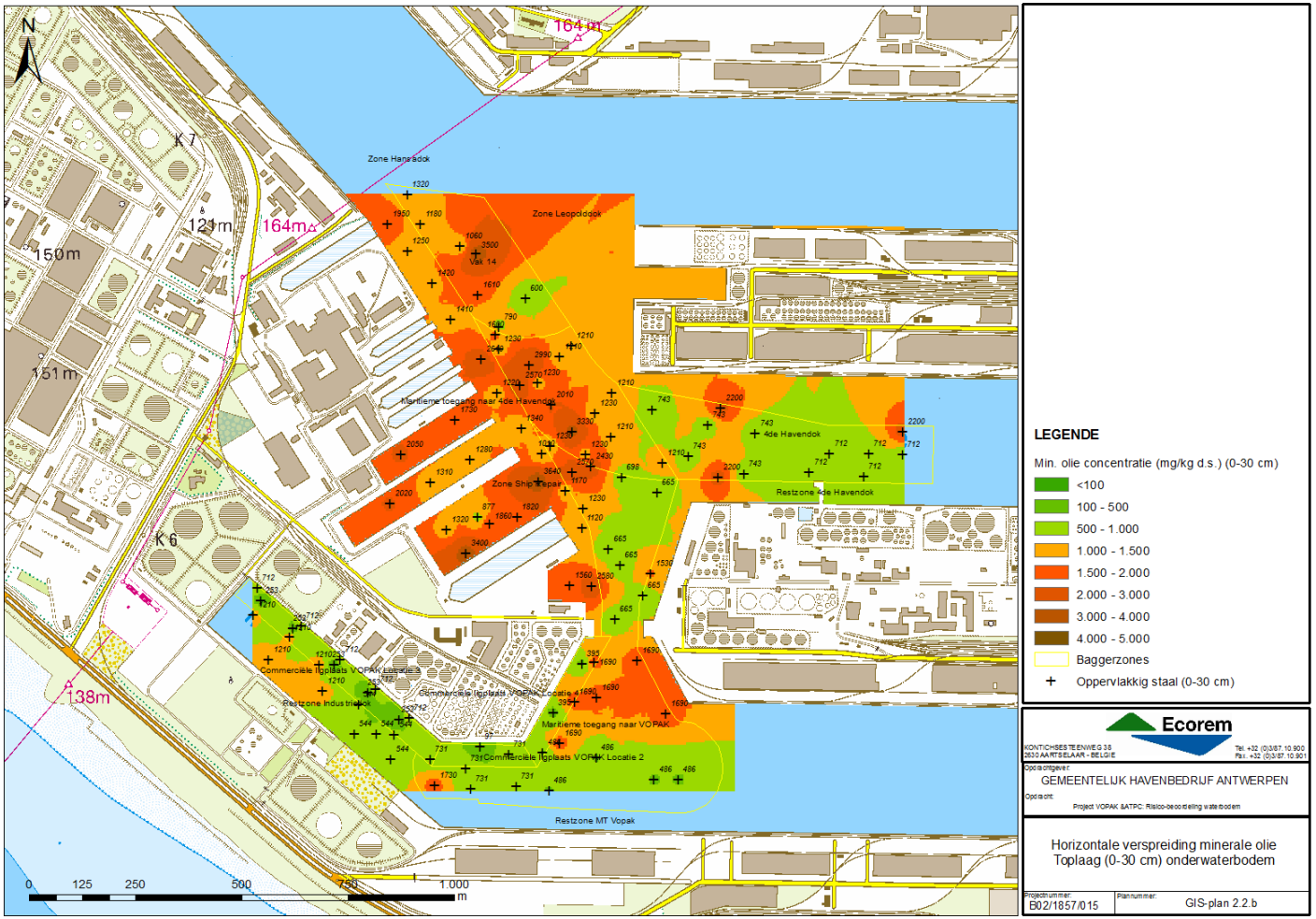
3.3 Pollution: MO before dredging works



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3.4 *Project objectives/questions*

- Are there increased risks expected during/after the planned dredging?
- Is there a risk of residual contamination?
- Can precautions be taken in order remove these risks?
- Can environmental costs and profits in order to remove the residual contamination be quantified?

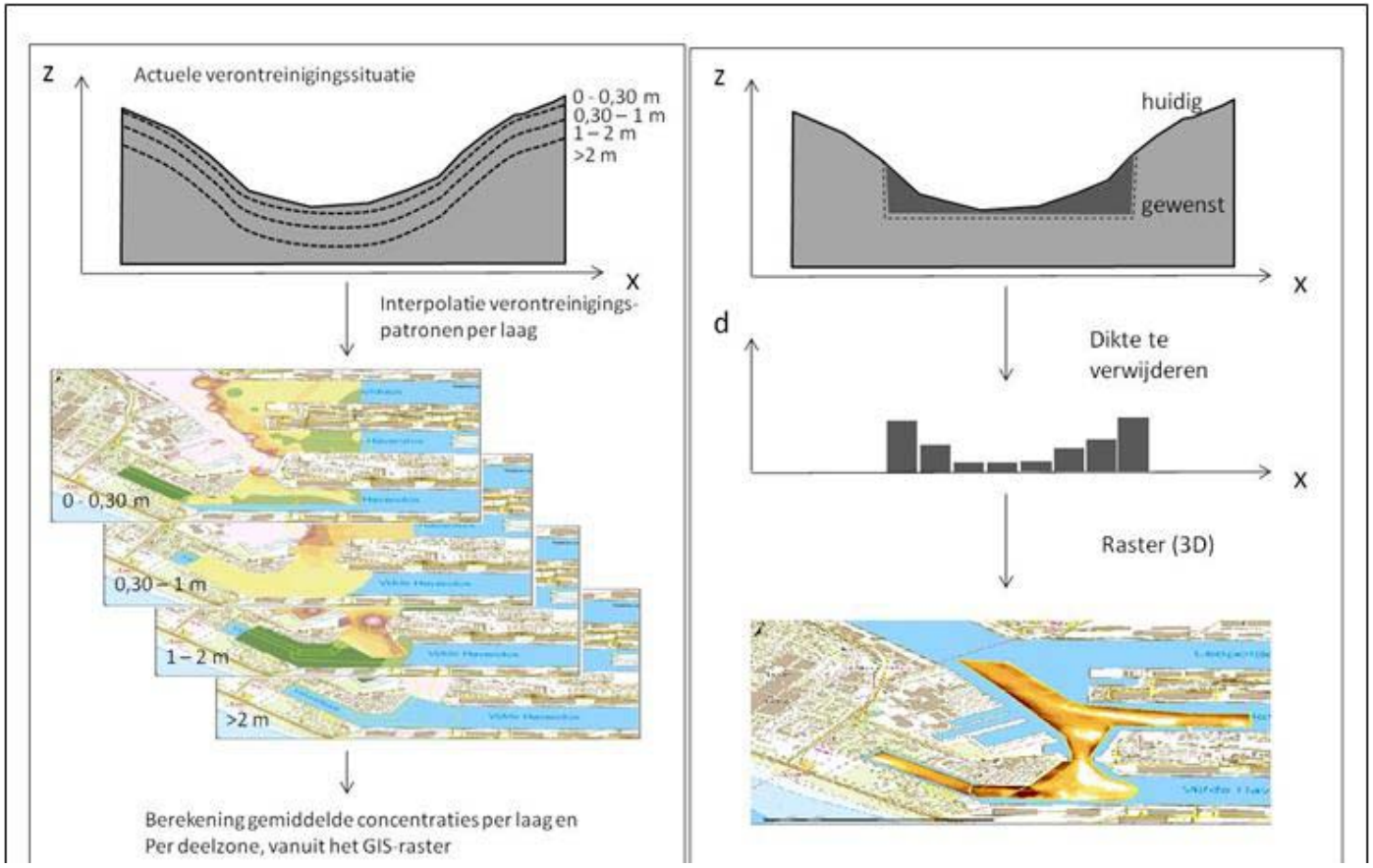
3.5 *Results*

- Are there increased risks expected during/after the planned dredging?
  - o (Re)suspension of polluted sediments (depending on sediment charge, dock currents, ship movements, …)
  - o TBT and MO dissolve to the liquid phase
  - o By removing the top layer of less polluted sediment, deeper potentially more polluted layers go in contact with the dock water.
  - o Additional analytical testing of the sediment load is needed.

3.5 Results

Is there a risk of residual contamination?

– GIS analysis



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3.5 Results

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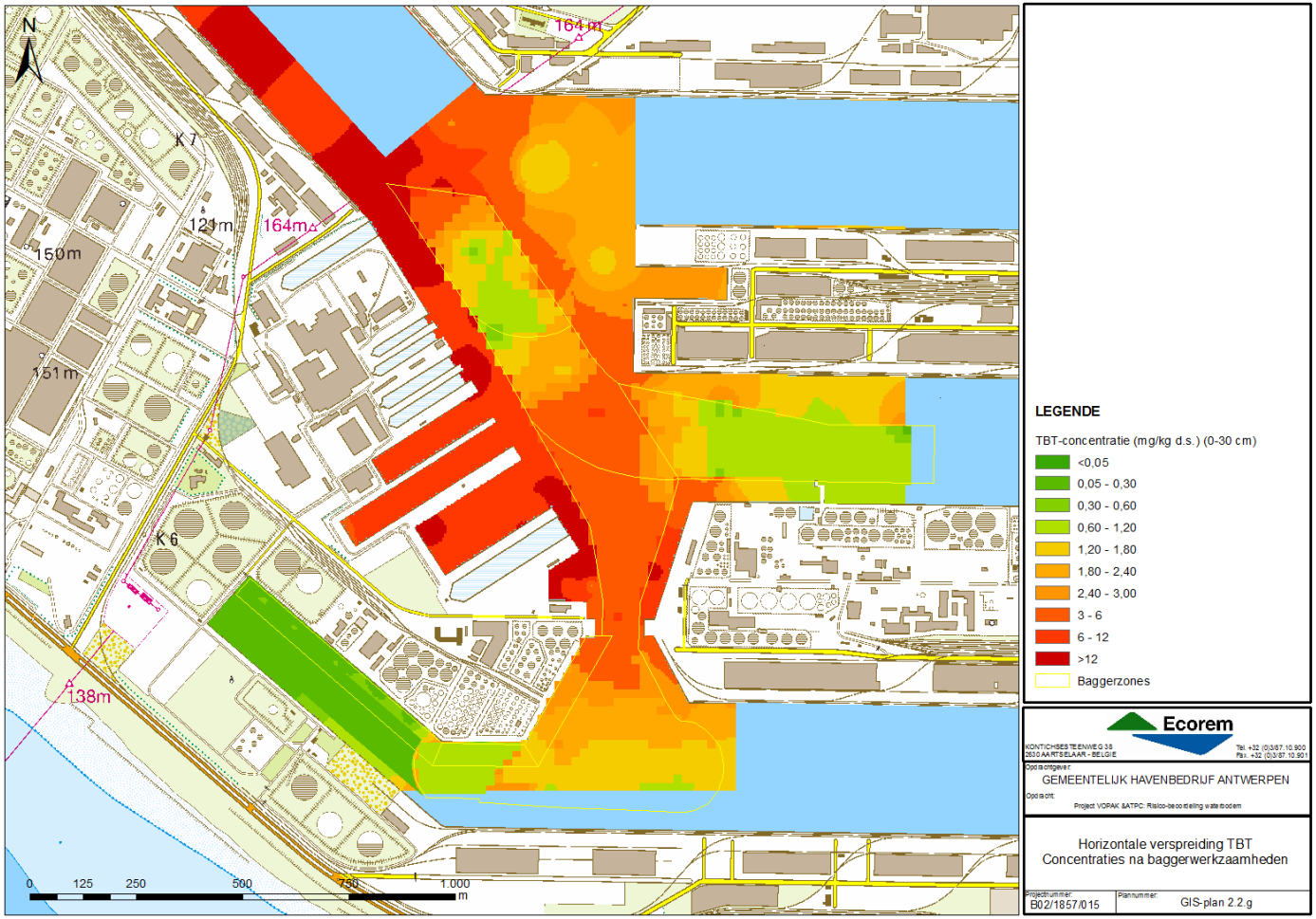
Is there a risk of residual contamination: TBT



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3.5 Results

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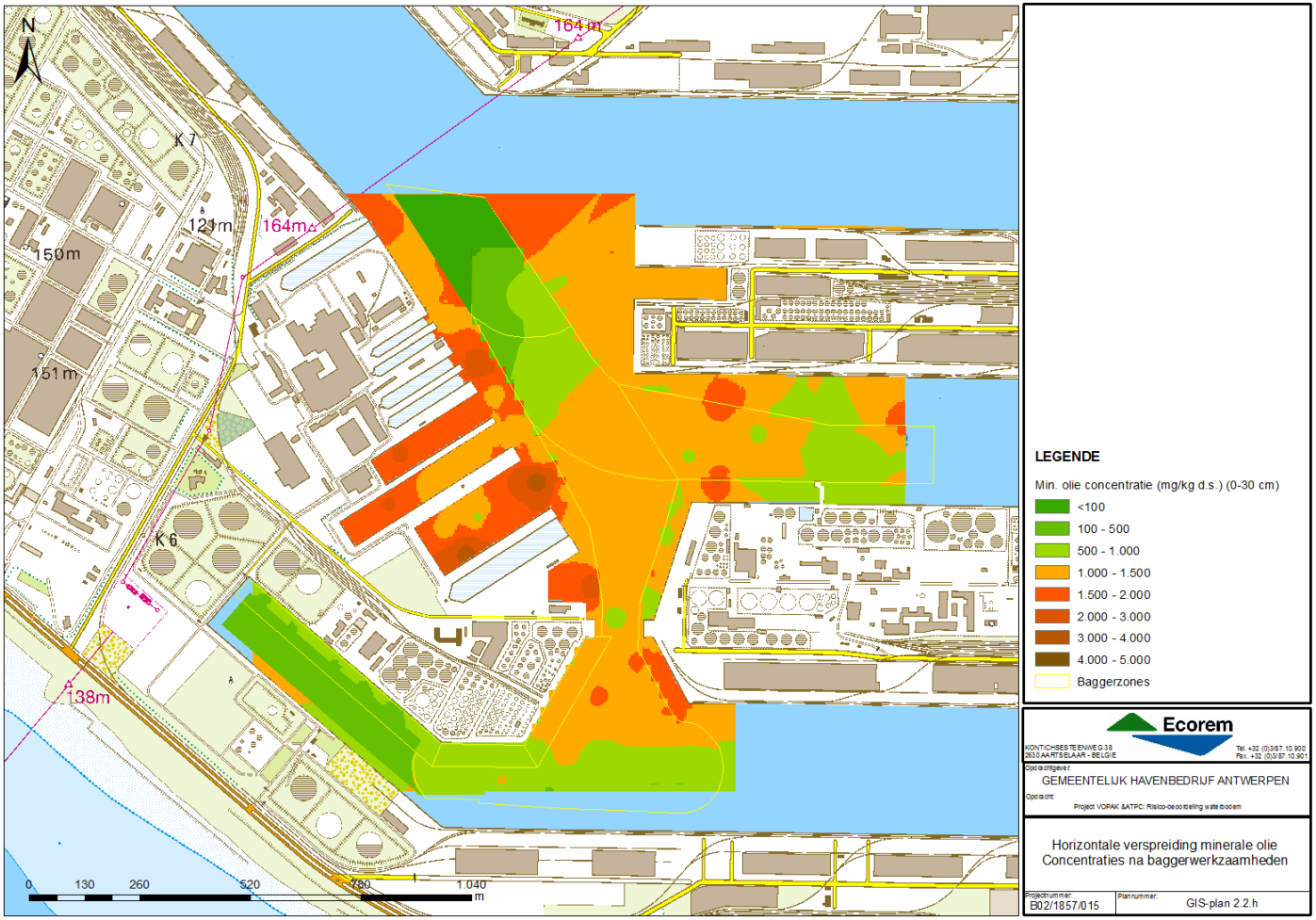
Is there a risk of residual contamination: MO



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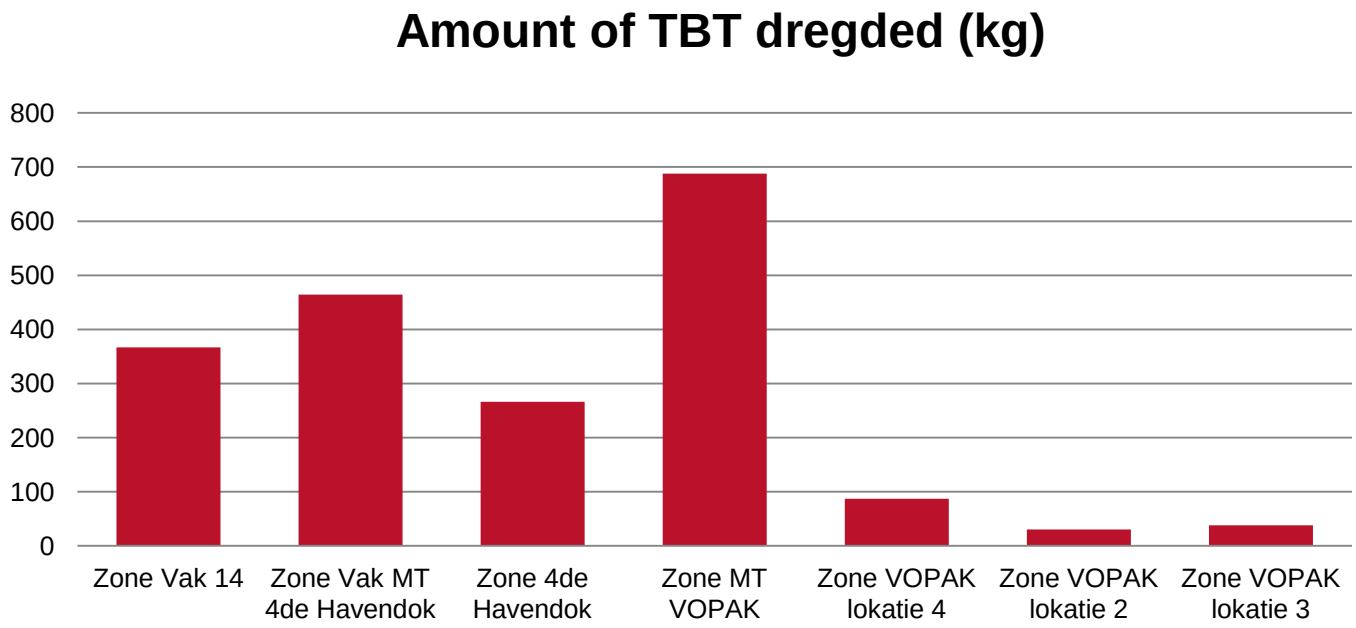
3.5 Results

Approximately 1.940 kg TBT and 1.000.000 kg MO will be dredged



3.4 *Project objectives/questions*

- Which precautions be taken in order remove the risks?
  - Monitoring turbidity during dredging activities (16/11/2012 → 28/11/2012)
  - Remediate (removing – covering or combination of both) the most polluted zones (wet docks most and embankments)

4

Case study: Monitoring campaign turbidity

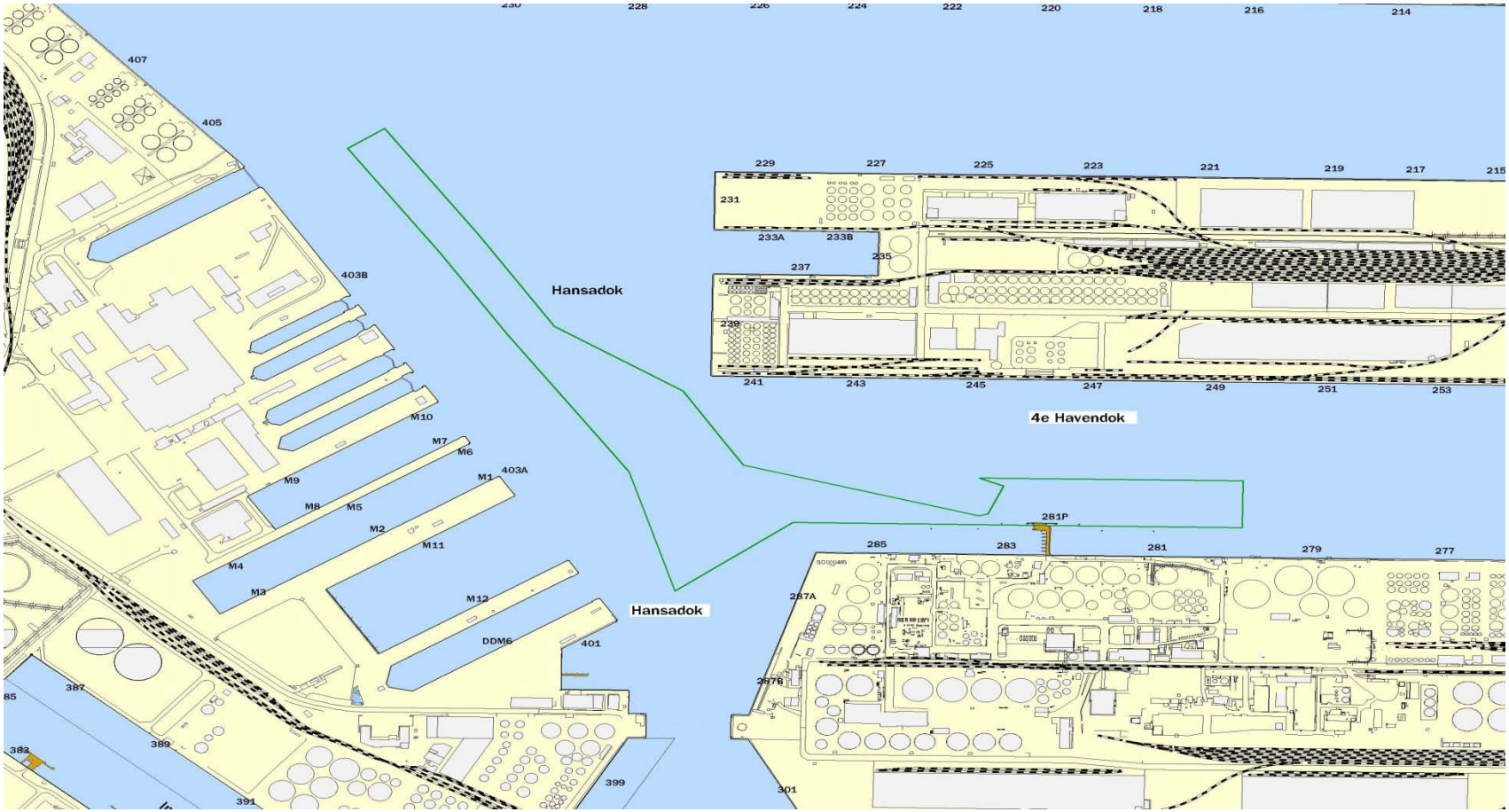
Case study: Monitoring campaign turbidity

4.1 Study area

4.2 Results

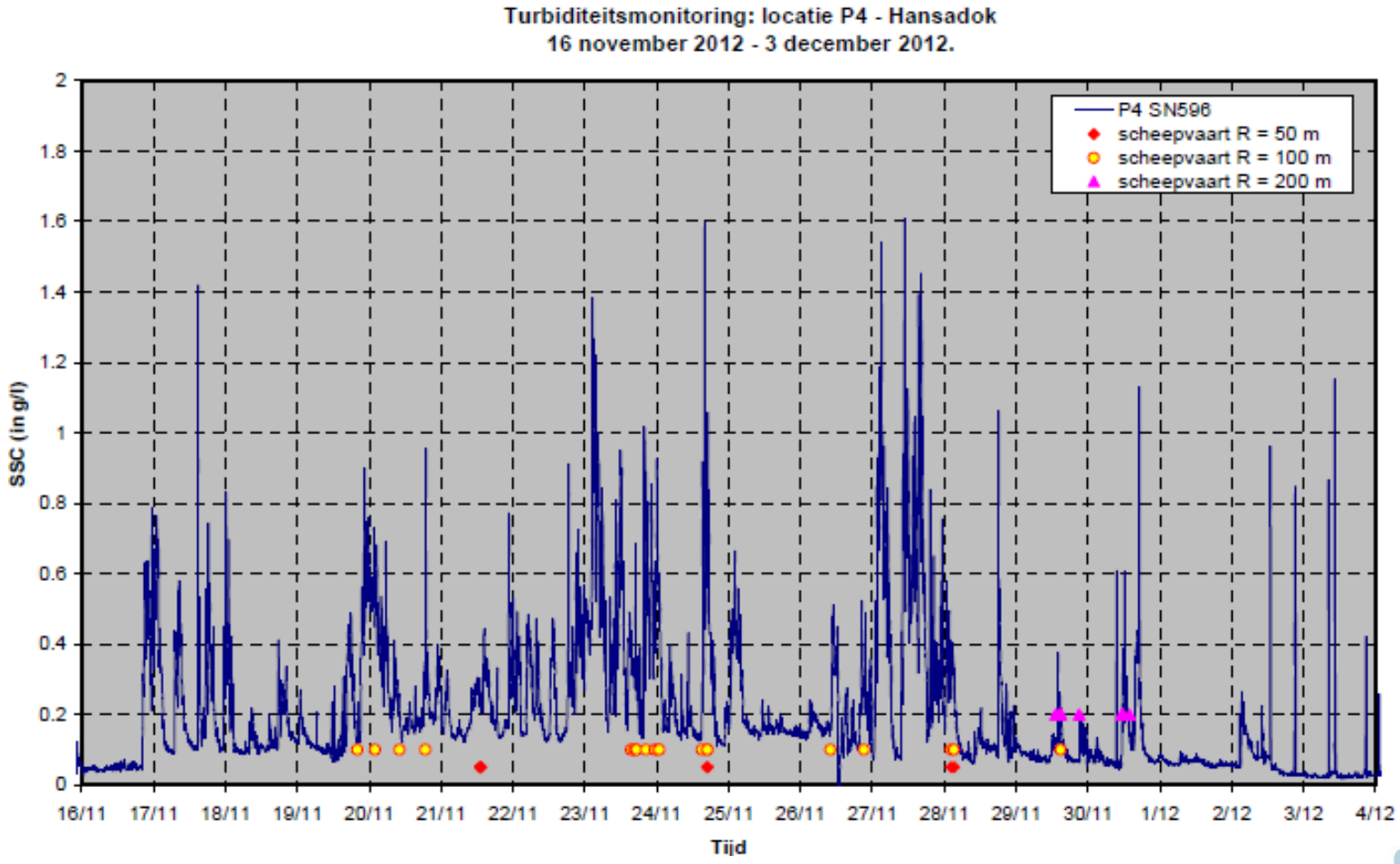
4.3 To be investigated

Case study: Monitoring campaign turbidity

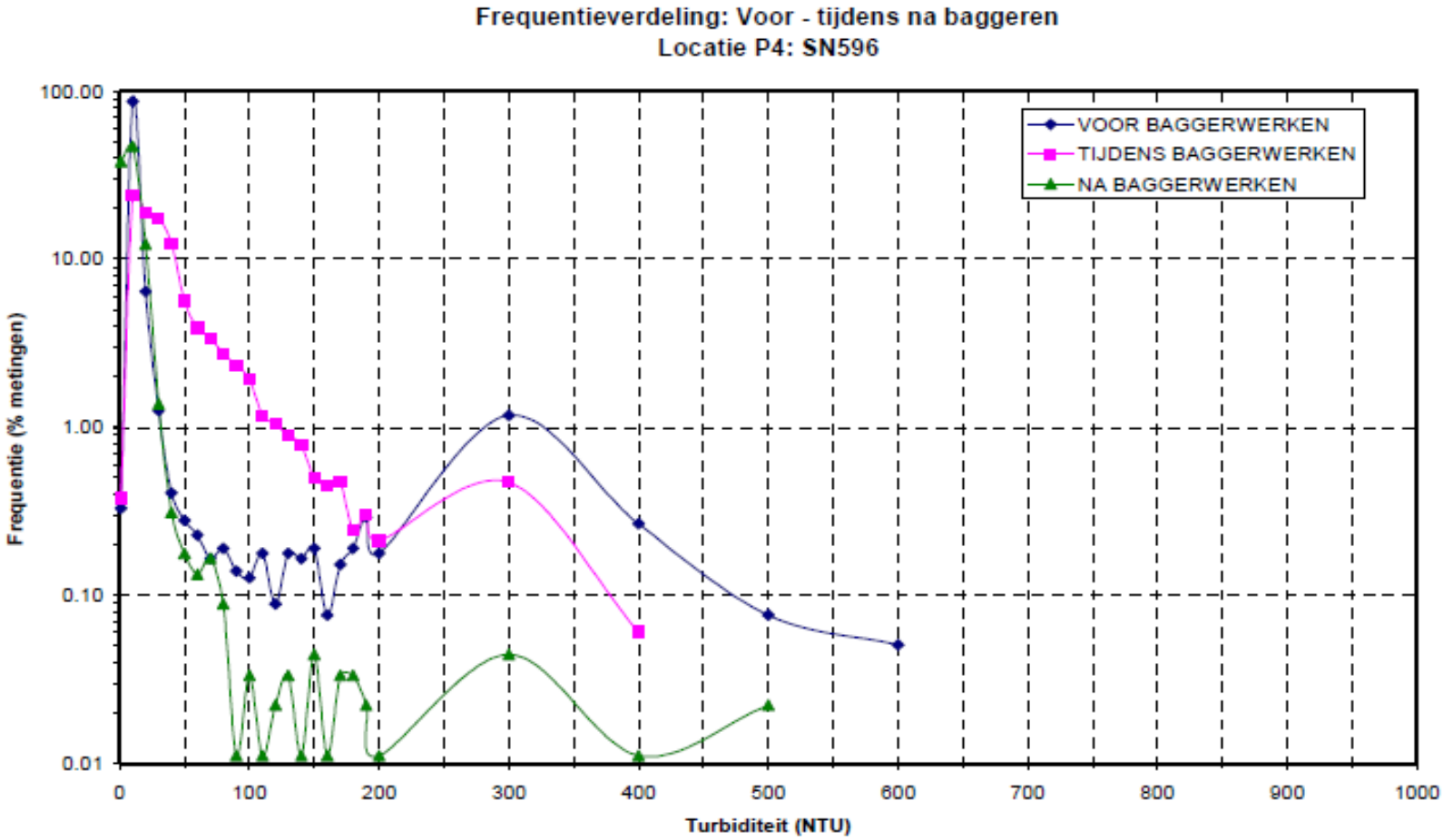


4.1 Sampling locations turbidity

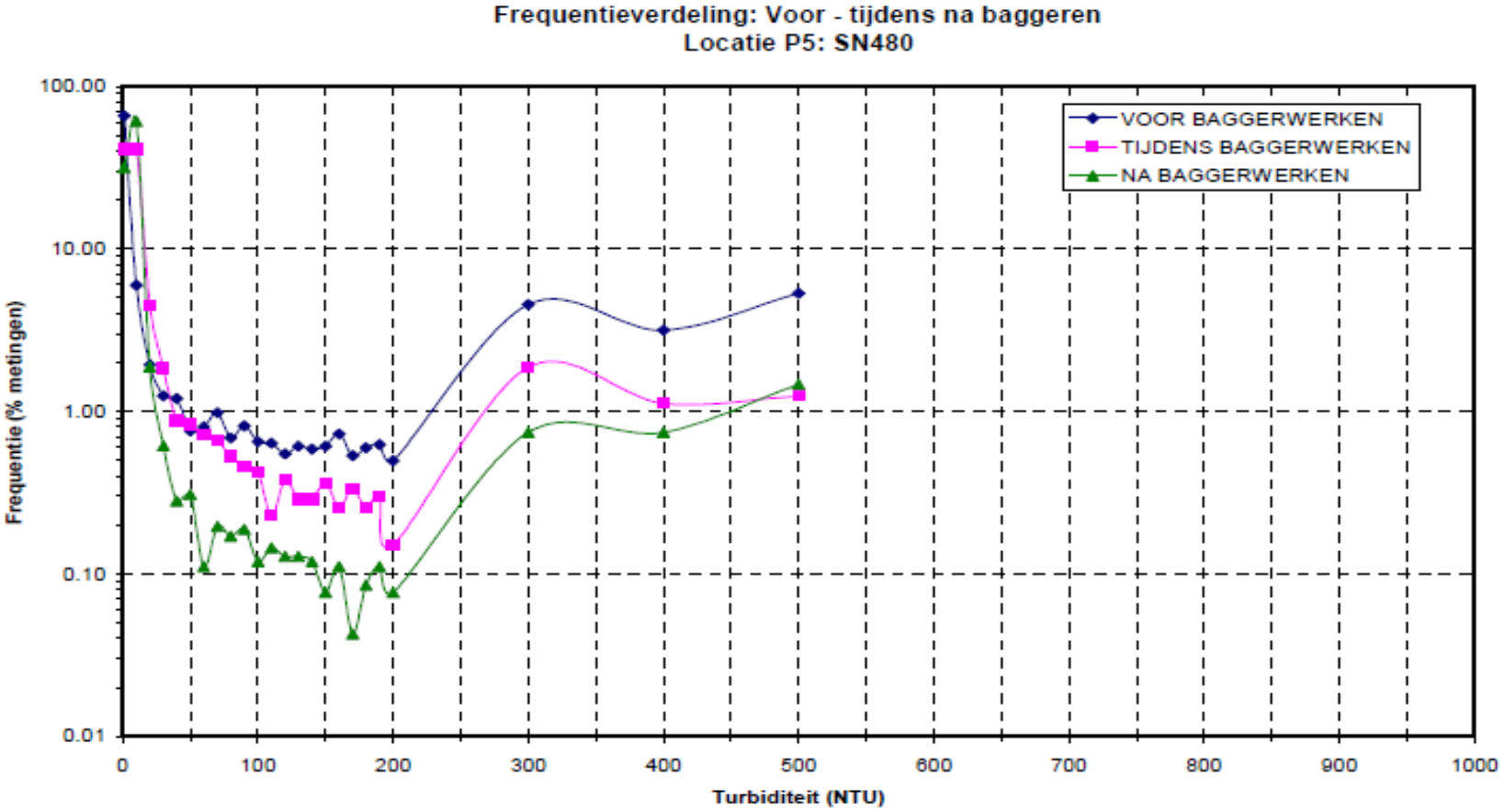
4.2 Results: turbidity is limited in time



4.2 *Results: turbidity is limited in space*
P4 closer to dredging activities vs. P5 away from dredging activities



4.2 *Results: turbidity is limited in space*
P4 closer to dredging activities vs. P5 away from dredging activities
Lower turbidity after dredging activities



4.3 *Has the increase of turbidity (even though limited in time and space) an influence on water quality?*

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Follow up – resuspension test

- Simulation of dredging events in laboratory conditions
  - Effects of mobilisation of sediments on quality of overlying water in function of time and different mobilisation scenarios
  - To be executed

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Thank you
for your attention

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